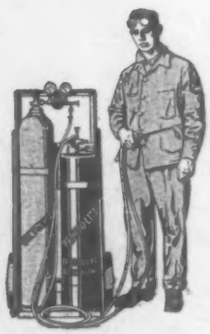
The Welding Engineer

Vol. II. Chicago 608 S. Dearborn St. JUNE, 1917 $2.00 per year in U. S. $2.50 per year abroad No. 6

Prest-O-Lite
Acetylene Service



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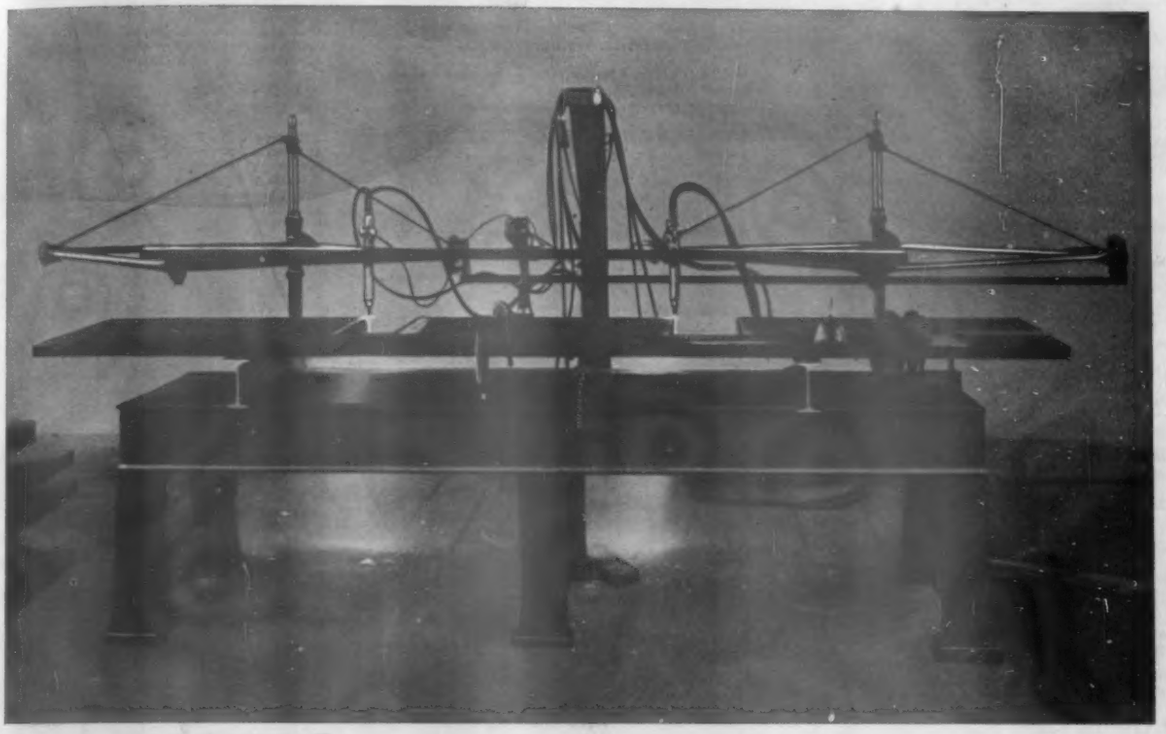

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Cutting Plates ¼ to 20 inches thick **Speed 4 to 15 inches per minute**

The Oxygraphs, Nos. 1 and 2, and the Radiagraph, are exclusive Davis - Bournonville developments for mechanically cutting steel plate, ingots, billets, and risers, with the oxy-acetylene and oxy-hydrogen flame. With the Oxygraph, steel plate up to 20-in. thick is cut in any direction, following pattern or tracing, along straight or irregular lines, curves or sharp angles, with equal facility, at speeds varying from 4 to 15-in. or more per minute according to thickness. The No. 2 Oxygraph is a heavy-duty machine, and with two torches, duplicate cuts are made, as in the illustration showing side frame being cut out for journal boxes. Frame of the machine moves back to permit service by shop crane.

Oxygraphs and Radiagraphs are extensively used by American Locomotive Co., Canadian Locomotive Co., Lima Locomotive Co., J. G. Brill Co., Lukens Iron & Steel Co., Bethlehem Steel Co., Carnegie Steel Co., Crucible Steel Co., Youngstown Sheet & Tube Co., Camden Forge Co., E. W. Bliss Co., Marion Steam Shovel Co., American Brass Co., United Shoe Machinery Co., General Electric Co., Westinghouse Electric & Mfg. Co., Canadian Westinghouse Co., New York Shipbuilding Corp., Newport News Shipbuilding & Dry Dock Co., Pennsylvania Shipbuilding Co., and in numerous other metal working plants, including United States Navy Yards at Boston, Brooklyn, Philadelphia, Norfolk, Charleston, Washington, San Francisco and Seattle.

Broad basic patents Nos. 1,059,329 and 1,118,183 cover cutting torches and mechanical means for supporting and propelling same at uniform and determined speed.

Manufactured and sold only by the Davis-Bournonville Company, which has developed the widest range of equipment made for utilizing the oxy-acetylene and oxy-hydrogen processes of welding and cutting, and **"Davis Apparatus" Leads the World for Range, Efficiency and Number of Successful Users.**

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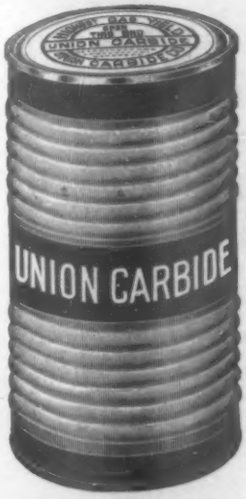

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Middlesboro—
LOUISIANA
New Orleans—819-21 Julia St.
MAINE
Portland—202 Commercial St.
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Baltimore—19 E. Lombard St.
Cumberland—1 N. Liberty St.
Salisbury—Opp. Fulton Station.
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Springfield—Napier St.
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Detroit—3rd and Holden Aves.
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Vicksburg—1312 Washington St.
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Kansas City—1316-1318 W. Eighth St.
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BASTIAN-BLESSING
COMPANY

125-131 W. Austin Ave.
Chicago, Ill.

Generator Safety Valve

This diaphragm valve is positive in operation and absolutely safe. Approved by National Board of Underwriters on several generators.

Far superior to ordinary, old style safety because it is so designed that it opens and closes with minimum loss of pressure.

Write for our catalog.

We sell manufacturers and jobbers only.

REGO TRADE MARK

THERMALENE GAS THERMALENE

The Oxy-Thermalene Method

of Welding, Cutting, Brazing, Etc.

The only Acetylene Oil Gas Producer in the world. Saves 25% on gas and oxygen. First class references.

Thermalene gas in conjunction with Oxygen gas produces the ideal flame for welding and cutting.

There is no loss of time due to shortage of gas. The Producer works only when you work. When shut off, Producer ceases instantly.

Thermaline will not produce faulty welds due to impure and moist gas. The Producer may be mounted on a truck and made portable.

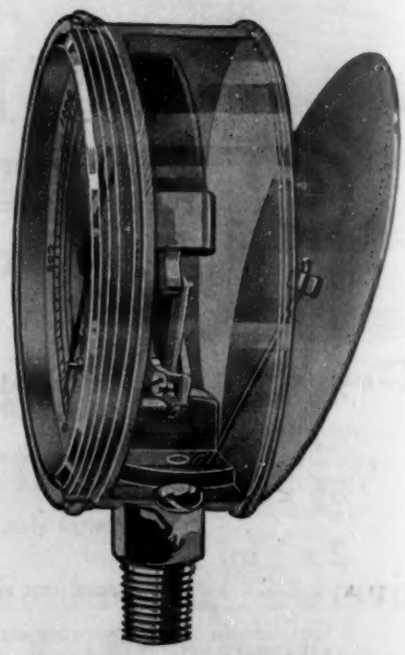
Thermaline Gas, being heavier and richer than Acetylene and other gases, has more body, producing a softer non-oxidizing flame, which assures a more uniform weld and a cleaner cut, without burning or making the metal brittle.

Write for full information, catalog and prices.

THE
THERMALENE
COMPANY
Chicago Heights, Ill.

We Will Sell Patent Outright for England, Canada, France, etc.

SAFETY FIRST



Patented July, 1916

OXY-ACETYLENE GAUGES

for

WELDING and CUTTING APPARATUS

United States Gauge Co.

67 Wall St., New York

WORKS:
Sellersville, Pa.

BRANCHES:

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Chicago, Ill.

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681 Market Street
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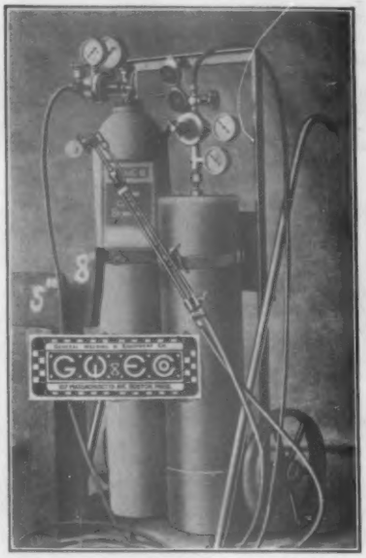
Montreal, Can.

Pure
Oxygen and Hydrogen
Efficient
Welding Apparatus

Universal Oxygen Company
Sheboygan, Wisconsin



STANDARD CUTTING Equipment

Consisting of:

Oxygen Regulator of the double diaphragm type with forcibly guided seat; with 2 gauges and check valve outlet which prevents explosive mixtures from entering the regulator body. High pressure gauge with solid front and safety release on back. (U. S. Government standard.) Acetylene regulator of similar construction. Cutting Torch with 4 interchangeable tips and a pair of guide wheels (several thousands of these cutters sold within the last 18 months). Two lengths of high pressure hose, 25 ft. each, Goggles, Wrenches and Instruction Book, all packed in steel box.

An Equipment which forced its way into the most prominent concerns by reason of its fine points of construction and its practical efficiency.

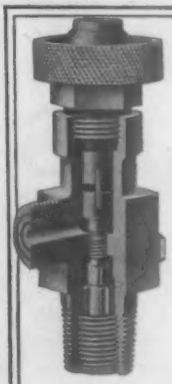
General Welding and Equipment Co.
107 Massachusetts Avenue, BOSTON, MASS.

Hold on! What were you doing just then? Storing away that interesting bit of welding experience, or a photograph, perhaps? Don't do it? Give it to us. We want to show it to 4,099 other readers of The Welding Engineer (you're the forty-one hundredth). If there are objectionable features to it, just leave it to the Editor (he studied surgery), cutting off and adding to is his hobby.

Another thing, when you work out a successful solution to a welding problem write us about it. Grammar and composition don't count—it's ideas we want. If a sketch would illustrate your job in good shape, just make a rough pencil sketch; our draughtsman will do the rest.

If the welding industry is to grow, you welders must pass along your experiences. We pay for them.

THE WELDING ENGINEER
608 S. DEARBORN ST., CHICAGO



"Matheson Automatic" Cylinder Valve

Force applied to open tank.

Pressure utilized to retain contents.

Cylinder Valves of all types.

Welding Supply Co., Inc.
High Pressure Tanks, Valves, Welding Appliances & Supplies
132 Nassau Street
NEW YORK

Welding and Cutting Apparatus

Thermalene Producers

Electric and Gas Welding Supplies

Swift Oxygen

For Welding and Cutting

Unsurpassed for Quality

Pure Oxygen Electrolytically Made under the direct supervision of our Chemical Laboratory. It is carefully controlled by chemical analysis, thus insuring the highest obtainable purity.

We carry a large stock on hand so can fill orders immediately.

Swift & Company

Oxygen Department **Union Stock Yards, Chicago, Ill.**

Hints To WELDERS

Can you write intelligently about the welding work you do, or which is done under your supervision? That is to say, when you finish an interesting piece of work, can you set down on paper the manner in which you went about the job, how you prepared the work, how you preheated and how the job was done? Have you learned in the hard school of experience some little stunt which every welder ought to know? If you can answer yes to the above questions you are the man I am looking for. I'll pay you a fair price for that bit of experience and I'll print it in The Welding Engineer "Hints to Welders" where more than 4,000 of your fellows will see it. Write it down any old way—I'll polish it up. Make a rough pencil sketch and our draughtsman will fix it up fine. Line drawings are more practical than photographs. Do it today—the men on the firing line are waiting.

L. B. MACKENZIE, Editor

The Welding Engineer

608 S. Dearborn St., : Chicago

You Can Make Welding Safe

By Providing Your Men

with **HARDY WELDING GOGGLES** which absolutely eliminate the dangers of the harmful infra-red and ultra violet rays.

Our Welding Goggle Booklet is free and will be sent to you or any of your men upon request.

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Milburn mixing principle produces best work with minimum gas, and no flash backs, burnt tips, or other annoyances.

Exceptionally durable construction of torches insures long, satisfactory service. Regulators dependable and free from valve, diaphragm and gauge troubles.

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Our Service Plan
Xemplifies that
When your Railroad Company
Enjoys the use of it and a
Lot of Oxweld Equipment
Demands for power to the

R.ound House Foreman will

R.eceive no refusals

Simply because the Repair Force is
Efficient in every respect as a
Result of having been instructed in
Virtually every known application of
Incomparable Oxy-Acetylene Welding and
Cutting Equipment, which means
Economy and Efficiency.

Oxweld Railroad Service Co.
Chicago New York

Thomson Process
Electric Welding

The High Speed Steel Situation

High Speed Steel is way up in the air.

Whether it will ever come down again it is hard to say, but certainly not for a long time—long enough for a Thomson Electric Welder to pay for itself several times over.

Even at its lowest there will still be a tremendous advantage in favor of Thomson process.

And Its Remedy

Thomson Electric Welding gives you the advantage of making the hard wearing parts of high-speed steel while the non-wearing end can be made of cheap low-carbon meta

Countersinks, reamers, lathe, planer or shaper tools, center drills, screw drivers, cutter bars and thousands of articles now made of high cost steel can be made the Thomson way at less than ⅓ the cost—and just as serviceable.

It will pay you to investigate now.

Send for Illustrated Catalog

Thomson Electric Welding Co.
Originators of Electric Welding
Lynn, Mass.

THE K-G TORCH

It is a well established fact that the **"torch"** is the most important unit of an oxy-acetylene welding and cutting equipment.

The K-G Torch has a reputation in the trade which speaks for itself. We will gladly demonstrate the torch at any time and we guarantee it to be equal to any and better than most on the market today. Finally, the price will leave no argument open.

The Complete K-G Welding and Cutting Equipment is in every detail as reliable and efficient as the K-G Torch. All K-G supplies are guaranteed to be the highest quality goods.

Torches, Regulators, Hose, Gloves, Gauges, Goggles, Welding Rods, Wire and Flux, Oxygen, Acetylene and Blau Gas.

K-G Welding & Cutting Co.

(INCORPORATED)

556 West 34th St., NEW YORK CITY

Phone: 6358 Greeley

Vulcan I-B Pre-heating Torch

A Portable, one-man torch, weight loaded 25 lbs.

Burns in any position. Gives a roaring flame 24 inches long, for one hour on one gallon of kerosene.

You Need This Torch

Many a good welding job is ruined because of the lack of a first-class pre-heating torch. The Vulcan is rugged in construction, has no delicate parts and is easily operated. It is more efficient because the oil is practically gassed before burning. It does the work and does it cheaply.

Write for Circular

Alger Supply Company

Peoples Gas Bldg., Chicago

AMERICAN TORCHES

SET THE STANDARD

IN

OXY-ACETYLENE

Welding and Cutting Apparatus

Our Model O. W. Outfit is designed for heavy work and will withstand the constant service that the blacksmith and boiler shop demand.

An injector type torch recognized as the most efficient and due to the exactness of construction cannot be made to backfire. Large welding jobs that are entirely out of the range of the ordinary welding outfit are successfully and easily accomplished with the AMERICAN positively non-backfiring torch.

Write for descriptive booklet.

American Welding Co., Inc.

2724 Michigan Ave.

Chicago, Illinois

Just Off the Press!
A New Book on AUTOMOBILE WELDING

With the OXY-ACETYLENE FLAME By M. Keith Dunham

167 Pages **Price $1.00** ***Fully Illustrated***

This is the only complete book on the "Why" and "How" of Welding

Explains in a simple manner apparatus to be used, its care, and how to construct necessary shop equipment. Proceeds then to the actual welding of all automobile parts, in a manner understandable by everyone.

Gives principles never to be forgotten. Aluminum, cast iron, steel, copper, brass, bronze and malleable iron are fully treated, as well as a clear explanation of the proper manner to burn the carbon out of the combustion head.

Automobile Owners, Garage and Service Stations, Blacksmiths and Machine Shops, as well as industries using the oxy-acetylene flame, will find this book of the utmost value, since the perplexing problems arising when metal is heated to a melting point are fully explained and the proper methods to overcome them shown.

CONTENTS

CHAPTER I.—APPARATUS KNOWLEDGE.
Oxygen Supply—Care of Oxygen Cylinder—Acetylene Generation—Care of Generator—Regulators—Care of Regulator — Creeping Regulators — Gauges—Care of Gauges—Welding Torch—Care of Welding Torch—Effects of Heat—Hose and Goggles.

CHAPTER II.—SHOP EQUIPMENT AND INITIAL PROCEDURE.
Preheating Agencies—Welding Table—Location of Welding Outfit—Starting the Welding Outfit—Adjustment of Flame—Principle of Welding—General Welding Knowledge—Welding Rods and Fluxes—Choice of Tip—Expansion and Contraction.

CHAPTER III.—CAST IRON.
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CHAPTER IV.—ALUMINUM.
Use of—Welding Knowledge—Puddle System—Flux System—Comparison of Systems—Welding Rod—Preparation of the Weld—Inlet Manifold—Arm of Crank Case—Welding the Arm Without Taking Out the Motor—Break in the Body of Case—Welding Cold—Wrong Method of Setting Up—Lug or Boss Welding—Preheating the Case—Gas Preheating Flame—One Side or Both—Collapse of Weld—Broken Bearings—Direction of Welding—Shrinkage Cracks—Missing Parts—Finishing—Die Moulded Castings—Body—Other Parts.

CHAPTER V.—STEEL.
Welding Knowledge—What the Flame Does to Steel—The Welding Rod—Simple Welding—Position of Flame—Reinforcing the Weld—Frame Welding—Lengthening the Chassis—Tube Housings—Worn Parts—Gear Welding — Case Hardening — Light Metal Welding—Gasoline Tank—Welding Adjacent to Rivets—Shaft Welding—Construction of Parts.

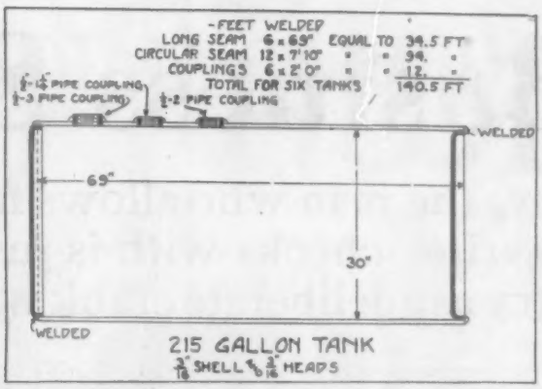
CHAPTER VI.—MALLEABLE IRON, COPPER, BRASS, BRONZE.
How to Detect Malleable Iron—Brazing Malleable Iron—Rear Housing—Reinforcing the Braze—Brazing Tube to Housing—Building Up Worn Parts—Copper—Brass and Bronze—Silver Soldering.

CHAPTER VII.—CARBON BURNING AND OTHER USES OF OXYGEN AND ACETYLENE.
Principle of Carbon Burning—Method of Operation—Lead Burning—Soldering—Case Hardening—Heating Uses.

CHAPTER VIII.—HOW TO FIGURE COST OF WELDING.
Oxygen Consumption—Dissolved Acetylene Consumption—Torch Consumption Test—Acetylene Generator Consumption—Cost Card—Conclusion.

Sent to any address postpaid on receipt of $1.00 **THE WELDING ENGINEER** 605 So. Dearborn St. CHICAGO, ILLINOIS

Compare Welding Costs


FEET WELDED
LONG SEAM 6 x 6.9' EQUAL TO 34.5 FT
CIRCULAR SEAM 12 x 7'10" " " 94. "
COUPLINGS 6 x 2' 0" " " 12. "
TOTAL FOR SIX TANKS 140.5 FT
1-1¼ PIPE COUPLING
1-3 PIPE COUPLING
1-2 PIPE COUPLING
WELDED
69"
30"
WELDED
215 GALLON TANK
3/16 SHELL & 3/16 HEADS

LINCOLN ARC WELDER

Time of Welding, 14 hours @ 30c an hour	$4.20
Kilowatts consumed, 60 kilowatts @ 2c per	1.20
Filling rod used, 27 pounds @ 7 3/10c	1.97
Total cost for 6 tanks	$7.37
Cost of Welding 1 tank	1.23

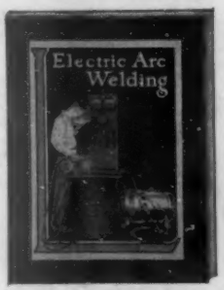
OXY-ACETYLENE TORCH

Time of Welding, 19¼ hours @ 30c an hour	$5.78
Oxygen consumed, 371 cu. ft. at .0135c	5.0085
Acetylene consumed, 325 cu. ft. at .008c cu. ft	2.60
Filling material, 15¾ lbs. at 12c per lb	1.89
Total cost for 6 tanks	$15.2785
Cost of Welding 1 tank	2.54

The Lincoln Arc Welder

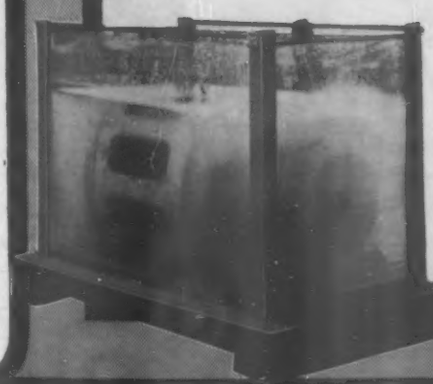
did this work at less than half the cost of acetylene welding. It was done under actual shop conditions using both methods for exactly the same amount of work, viz., welding six, 215 gallon tanks, 3/16″ shell, 3/16″ heads, with one 3″, one 2″ and 1¼″ Standard Couplings.

This is only one case out of many where a manufacturer after a careful comparative test has adopted Lincoln Arc Welders to replace acetylene welding, thereby making sweeping reductions in the costs.



Of course "the proof of the pudding is in the eating," and we will be glad to help you make the trial in your own shop.

Ask for Bulletin 104-L
Write on Your Business Letterhead



The Lincoln Electric Co.

CLEVELAND, OHIO

New York City (Singer Bldg.)	Chicago	Philadelphia
Buffalo	Columbus	Pittsburgh
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	Grand Rapids	Toronto, Canada

Agencies in other principal cities

Don't be
A Business Slacker

Right now the man who allows fear to paralyze the hand he writes checks with is just as dangerous to his country as a deliberate crank who throws a bomb

The Premier Motor Corporation believes that the business slacker here at home is our one real enemy—far more of an enemy than the Kaiser, because the Kaiser cannot get at us.

If you cannot thrust a bayonet, you can at least drive your business harder than you have ever driven it before and thus help create the imperative prosperity with which alone this war can be won.

It betrays weak-mindedness to think of diving headlong into a period of panic, penance, abject fear and hysterical economy.

The man who sneaks down and buys a marriage-license life preserver is not the worst breed of slacker. Conscription will take care of him. But for the business slacker there is no law but his own conscience.

The man who destroys business takes the bread out of the mouths of thousands.

No matter what comes—

Don't be a Business Slacker.

* * *

Right now is an almighty good time to take the bull by the horns and look him square in the eye.

America is at war. It is a big war—a very big war. It may be a long war. And when we try to imagine what may happen no one can blame us for looking serious.

But there is absolutely no reason for being scared, or, in a business way, even apprehensive.

We cannot avoid the firing line—we can avoid the bread line.

WAR IS TRANSIENT—THE UNITED STATES IS PERMANENT

The demands on us will be great—but our resources are inexhaustible. The United States today has the larger part of all the real money in the world. But money is just like a man—if it is inactive it is useless. While we are talking about making our factories and our farms *produce*—let's not forget to keep our money producing. We will encounter serious problems, but American ingenuity and inventive genius is equal to any emergency.

We are going to win this fight because we are on the side of *right*—and when we come out of it *we are Going To Be a Real Honest-to-God Nation.*

Meanwhile, what about business?

The real barometers of America's business are the smoke stacks to her factories—her dinner pails—and the mouths of her one hundred millions.

AMERICA IS GOING FULL SPEED AHEAD—DON'T LET ANYBODY TALK YOU OUT OF THAT

Even if America desired hard times, the world would refuse her the wish. We have been conscripted as the world's kitchen, the world's shipyard, the world's bank—*the World's General Business Manager—Carte Blanche.*

America is bound to be prosperous. That's her part in the war. Someone must keep wealthy enough to meet this war's pay roll. That's our job. As a result, the great mass of men, women and children in this country can no more avoid getting money out of this present emergency than a lily in the rain can avoid getting wet.

Get these facts through your head, for they are the only true facts on which you can base your business plans.

AMERICA HAS TAKEN WHAT AMOUNTS TO A SEVEN-BILLION-DOLLAR ORDER

And, mind you, this is only the first of many such orders. Seven Thousand Million Dollars' worth of shoes, canned goods, harness, motor trucks, automobiles, ships, blankets, clothes, guns, munitions and *what not* must be manufactured and delivered. Who gets this *seven billion?*

If you are a merchant, every customer on your books will get a piece of it. If you are a manufacturer or mechanic, you yourself will get your part of it.

There is going to be no *non-productive* labor or capital in this country. Everybody *must* produce—which means that everybody *must* be on somebody's pay roll.

For at least three years America cannot avoid being the most prosperous nation the world ever saw.

America's Wealth is About to be Redistributed and Put in the Hands of Our People.

—not in the hands of the hoarding few.

When our people get money they have the courage to spend it.

So look out for big business—*Tremendous and Inevitable Big Business*—and get ready to take care of it when it comes.

We assure you that the Premier Motor Corporation, for one, proposes to keep right on building and selling and creating its share of the wealth with which this war must be fought, and we have reason to believe that the whole motor car industry feels exactly the same way about it.

The biggest week Premier ever had was last week—our biggest day so far was yesterday.

—and it looks now as if we had only started—proving that honest merit still wins. Premier, with its unheard-of advantages and its unquestioned quality, consitutes real economy at $1985.

If you have thought of buying a car this year, go ahead and buy it.

* * *

Meanwhile, remember that the man who allows fear to paralyze the hand he writes checks with is as dangerous to his country as the deliberate crank who throws a bomb.

Premier Motor Corporation.

We are republishing without expense to the Premier Motor Corporation this advertisement which appeared in N. Y. Times. It is so good that we do not want our readers to miss it.

THE WELDING ENGINEER

Canada Carbide Sales Company

30 Church Street, NEW YORK CITY

WORKS
Shawinigan Falls, Que.
Merritton, Ont.

Sales Agents of

CANADIAN CARBIDE

"More gas per pound"

SIZE PKGS
100 lb. and 1,000 lb. 25-lb. drums; 10 lb., 5 lb., 2 lb., 1 lb. tins

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Trumansburg—55 Main St.
Valley Stream.
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Manuf'd in all standard sizes

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WELDING *and* CUTTING *with* OXYGEN *and* ACETYLENE

III.—Cast Iron Expansion Problems

By M. Keith Dunham

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Estimating Contraction

Having grasped the importance of understanding that cold metal occupies a smaller space than hot metal, we must at times estimate roughly at least how much this hot metal contracts in order that we maintain with some degree of exactness the alignment of the article welded. In the previous issue, a wheel with a broken spoke was illustrated and it was pointed out that by heating the rim at two points the break opened up, the weld was made and by taking away the heat from the rim, the spoke contracted. This, of course, was an illustration of one method of allowing for the effects of contraction; or in other words *providing for the fact that cold metal occupies a smaller space than hot metal.* How hot shall we heat the rim and how far apart shall the edges of the break be separated before the weld is started? At best, it is only possible to outline general principles of expansion and contraction. Each repair job is usually different from the one just done and the operator must learn by these general principles and by his own experience. It is to be remembered that a bar of cast iron which is one foot long when cast will be over an eighth of an inch shorter when cool. Assuming the spoke of a wheel to be a bar, we must then take into consideration how much of that spoke we are going to bring to a welding heat. As the acetylene flame is extremely concentrated, it is reasonable to assume that on a small spoke —say one three inches wide and half an inch thick—not more than four inches will come to a welding heat. As this is one-third of a foot, it might be concluded that if the break is allowed to open one-third of an eighth of an inch and the weld made, the spoke on cooling will be the correct length. But it must be remembered that expansion starts the minute metal is heated and while only four inches of the spoke has come to a welding heat, *the conductivity of the metal has allowed some heat to travel for some distance away from the weld*—perhaps a foot or two or three—and we must plan on all this metal being in a smaller space when it cools. To be sure, the contraction is not so great as if it were at the welding heat; nevertheless we must allow for it.

It may be seen that the thickness of the weld has something to do then with how much we shall heat the rim and how far the break shall be separated. The thicker the metal the longer it takes to execute the weld and the more heat is transmitted or conducted away and the wider we shall have to separate the edges of the break. On a small spoke, a sixteenth of an inch may be sufficient; on one six inches wide and a couple of inches thick a quarter inch would be more nearly correct. Whether the break is preheated or not also influences the determination of how far apart the edges shall be separated, and because of the larger amount of heat conducted down the spoke by the lower temperature of the preheating method than by the acetylene flame, the edges will have to be separated more than if the acetylene flame alone is used. It may be seen that it is quite easy to expand too much; in this particular class of welding it is a common fault.

Too often, perhaps, the student of acetylene welding gives too much thought to the effect of expansion and not of contraction. He has learned by experience to fear the crack of the cooling metal and to think that it is the expansion he has set up (a common expression) which is responsible. By bearing in mind that this hot metal occupies a smaller space when it cools and by planning to expand other sections before the weld is made so that the welded area is somewhat larger hot than wanted when cool, he will learn to guard against contraction. Think before the weld is made. It isn't good luck which is responsible for successful salvage welds; it's good sense.

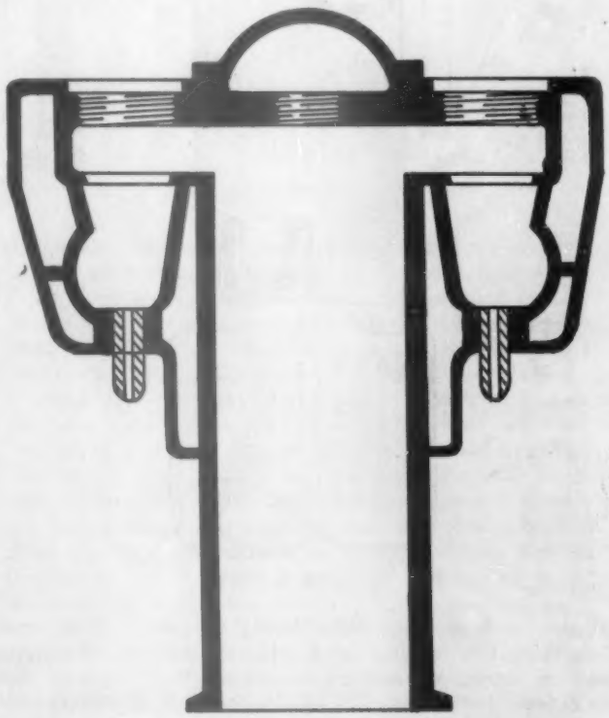

Fig. 1.

Cylinder Welding

Figure 1 illustrates a cross section of a typical automobile engine cylinder. From a welding standpoint, we may use this illustration in understanding the largest of gas cylinders, steam cylinders, etc. Single cylinders for automobiles are now a rarity but the en-bloc motor is just the same in principle as the single cylinder casting; simply two or four or six joined together. It will be noted that the outer wall (the water jacket) is usually lighter than the wall of the cylinder proper. The valve chambers are of heavy construction and joining the water jacket to the wall of the cylinder are also sections of quite heavy metal. In other types of cylinders, the spark plug bosses

may also join the jacket to the wall and be of much heavier construction than either the jacket or wall.

Given a cracked water jacket, *the workman must take into consideration all these conditions in order to make a successful weld.* Having learned that it is necessary to expand other portions by preheating in order that the cooling metal of the welded section has an opportunity to contract properly, it is readily seen that here we cannot preheat as we did the wheel, as the break does not entirely separate the piece to be welded as it did the spoke. It is necessary in this instance to preheat the entire cylinder (except as hereafter noted). We must bear in mind that it takes more heat to bring half-inch metal to a certain temperature than it does quarter-inch. We must likewise remember that the cylinder wall is joined to the jacket and that we must expand this wall as well as the jacket or stresses will be set up in cooling; *in other words we must heat as evenly as possible and as evenly cool.* How hot should an automobile cylinder be heated and how should it be heated?

Methods of Heating Cylinders

Charcoal is the fuel ordinarily employed in the job shop for preheating. Temporary fire brick furnaces may be constructed or it is practical to build a permanent furnace if enough of this class of work is done, leaving the top open to be covered by

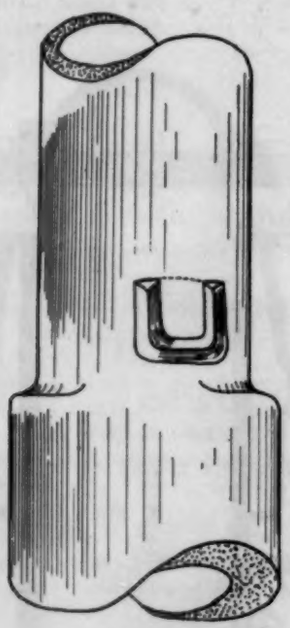

Fig. 2.

asbestos cloth or paper while heating or cooling, at the same time using this opening for turning the cylinder into proper positions during the welding operation. What position shall the cylinder lie in while it is being preheated? *It matters little, so long as it is heated slowly, remembering that not all parts are of the same thickness.* Some welders claim that it is preferable to put the cylinders in the fire in the same position they occupy while in use, bore down in the fire, claiming with truth that this method allows the heavier metal of the cylinder proper to reach the correct heat. It would seem that this is an unnecessary risk of blistering the bore, however; yet with certain types of cylinders or where the break is in a difficult location with relation to heavier metal being in proximity, it may be well worth trying. Certain that irrespective of position, the fire must be slow and it must heat all sections affected by the cooling metal of the weld evenly; and this means that the cylinder must be watched while heating and turned at times. The weld should be made while the cylinder is in the fire—never should it be removed and the weld made—for it is of the utmost importance that the weld is executed while the metal is expanded and not when it begins to cool and contract. *The degree of heat necessary before welding is started will vary according to location of break, but as a general rule a very dull red will be sufficient.*

Some years ago the author constructed a permanent furnace for cylinder welding. It was made from boiler plate, lined with asbestos and was sufficiently large to heat at one time a dozen single cylinders. Gas was the fuel used and to get the proper amount of heat, a positive pressure blower was employed. The gas entered the furnace through some thirty half-inch openings, striking against baffling plates to spread the flames and to insure even heating. The cylinders were inserted into the furnace on a small truck and the flames lighted. For the first half hour, the gas and air supply was kept at a minimum but after that were gradually increased and at the end of about an hour, the cylinder was ready for welding. It was found that this method heated the cylinders very evenly and many types which had been difficult or impossible to weld in the charcoal fire were successfully welded when heated in the gas furnace. The objection against this type of furnace was that the cylinder had to be removed while welding but this objection was partially overcome by welding only a small portion of the break if it was of any size and putting back in the furnace for a second heating.

It may be said that charcoal will produce excellent results if the workman is careful. For small shops it is undoubtedly the best fuel, but for the large job shops we look for the adoption of the gas heating furnace, with pyrometer attached to determine proper temperature. In this manner, much of the present lackadaisical, slip-shop preheating will be eliminated exactly the

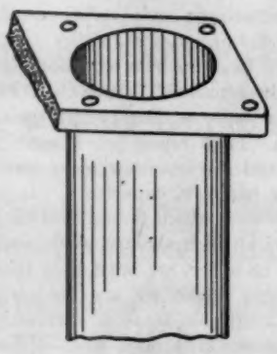

Fig. 3.

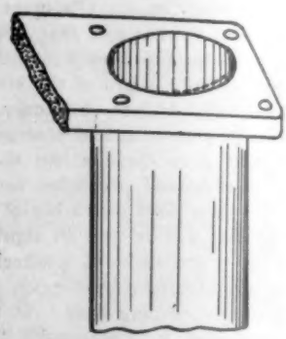

Fig. 4.

same as in modern shops tools are heated in this manner and not "by the eye" as was the method a few years ago.

Where the Weld Adjoins A Heavy Section

Figure 2 illustrates a type of break which many times causes difficulty in welding, particularly when the preheating has not been slow and even. That portion of the crack marked A to B adjoins the heavy metal of the spark plug boss. Unless this metal is as hot as the water jacket while the weld is being made, the heat from the flame is conducted rapidly by this heavier section and when the weld is completed, there is a stress on the jacket caused by this rapid conduction of heat. In order to guard against possible failure in cases like this, it is desirable to cut the jacket as shown by the dotted line, make the weld from A to B, allowing the "pull" by the heavier metal to be taken care of by this cut and then make the balance of the welds in the usual manner. *A safe rule to follow is to first make those welds joining uneven thicknesses and to last make the welds of even thickness* and where necessary hack-saw or cut a section in order to make a weld of even thickness last.

When Preheating Is Not Necessary

Recall *that to maintain softness of the metal, slow cooling is essential* and to avoid rapid conduction of heat from the weld, it is desirable to preheat the section to be welded. It is evident then, that intelligent preheating is usually demanded, both to secure a good quality of weld and to avoid fracture or warpage. At times, however, it may be impossible or impractical to preheat. When may it be avoided? Figure 3 illustrates the broken

flange of a cylinder. Preheating, while desirable in this instance to secure softness, is unnecessary to prevent fracture, though the bore will warp as shown by the dotted lines in Figure 4. The rim of a wheel would be another illustration of work of this description. When building up a broken tooth on a gear wheel, preheating then is not necessary to prevent fracture but is desirable to maintain softness.

Partial Preheating

It is practical at times, particularly with large castings, to heat only a section to avoid fracture. Large cylinders or tanks of cylindrical shape may be heated around the weld for some distance and because of the shape of the vessel (as is the case in heating the rim of a wheel to open the break at the spoke) the stresses set up by the cooling metal are evenly distributed.

Vertical Welding

It is frequently stated that cast iron may be welded only in a horizontal position due to the fluidity of the metal while in a molten condition. *This is true if no mechanical aids are introduced,* but sometimes the welder is called upon to weld a break "in situ" where the machine cannot be dismantled, yet where it becomes necessary to execute vertical welding. Carbon or graphite blocks may then be employed to hold the metal in place. These blocks may usually be secured from apparatus dealers. *In many cases it is possible to cut into proper shapes a discarded foundry crucible,* which is admirable for the purpose. The method used for vertical welding will be more clearly understood by reference to Figure 5. The carbon block is attached by means of clamps to the casting, but if the shape or location of casting does not permit this, bricks or iron may be used to hold it against the weld. The carbon block is of course some wider than the weld and is groved out to permit the weld being thicker than the original metal, thus reinforcing exactly the same as if the weld were made in the ordinary position. The block is from one to two inches wide, and as the break is welded upward the metal is allowed to cool and the block is

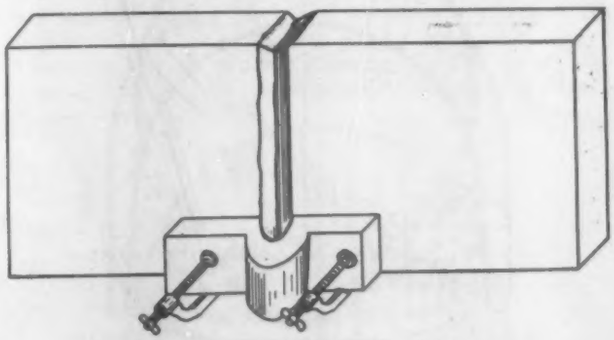

Fig. 5.

then moved upward, the same method being pursued until the weld is completed.

The author has in mind one job executed in this manner on an electric crane, the frame of which was about two feet high and two inches thick and which was broken in two places. To dismantle this crane, weld the frame, and re-assemble meant a couple of weeks time and the loss of the use of the crane. *It was welded by the carbon or graphite block method in one day,* with the aid of oil torches for preheating.

Other Uses Of Graphite Or Carbon

At times it is necessary to preserve a thread or a hole, where the break may be adjacent or even run through it. *As a general rule, it is better welding policy to fill the hole* and redrill, but where this is not possible, the carbon or graphite method may be used to plug the hole while welding. On small areas the carbon from a discarded dry battery may be used.

In building on metal for new bosses, teeth on gears, etc. the outline may be adhered to more closely by the use of graphite, first shaping it out as may be desired.

Range Of Cast Iron Welding

How heavy a section can be welded with the acetylene flame? The largest handled by the author was eighteen inches thick and about thirty inches wide, though sections heavier than this have since been welded. *Proper preheating is the basis of success on heavy work.*

Conclusion Of Cast Iron Welding

As previously stated, the actual welding of cast iron is quite simple. But as we have seen, the precautions to be taken to guard against warpage or fracture are of primary importance.

clamping the flat surface of the machine part to the table to secure alignment. The break was less than one inch thick and perhaps three inches wide. It was beveled in the usual manner and the weld made without preheating. When the weld was completed, it was found that the piece was warped as shown by

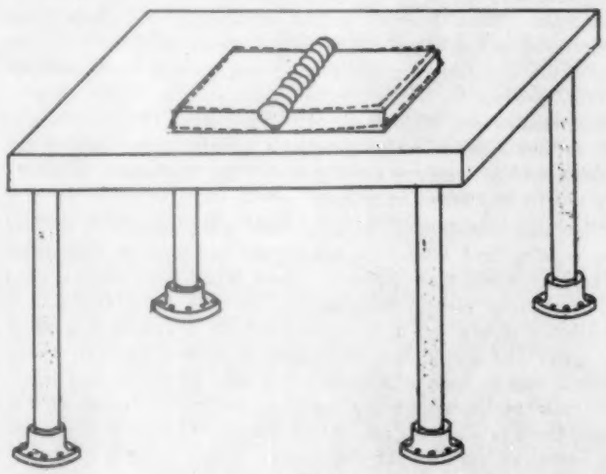

Fig. 6.

We must avoid sudden cooling to prevent hard welds. The author recalls an experience of welding a textile machine part, quantities of which were done on a cast iron welding table, the dotted lines in Figure 6. The cause was puzzling, until *it was discovered that the cold metal of the table was conducting the heat rapidly from the bottom of the weld,* allowing that section to cool and contract, and as the weld progressed in thickness, it was necessary for it to occupy a smaller space, and very properly the ends of the piece moved upward to take care of this shrinking of the metal in the weld. The bottom of the weld was hard due to its rapid cooling; *and the part warped because of lack of attention to the rule that cold metal occupies a smaller space than hot metal.*

Articles of incorporation have been filed for H. G. Doran & Co., Peoples Gas Building, Chicago, with a capital stock of $10,000. The company is formed for the purpose of manufacturing and selling mechanical and other devices. Harry G. Doran, president.

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Confining ourselves in the meantime to the subject of electric arc welding and taking up briefly the question of equipment, it may be stated that if direct current is available from a shop or commercial circuit, welding can be done from this source of electric supply, but it is not economical; in fact, it is a waste of power and should not be thought of expect, perhaps, where welding may be done at only rare intervals. In such a case unless particular arrangements are made in regard to insulating the work, there is a certain amount of danger not only to the welding operators but to other employees. Where there is a reasonable amount of welding to be done it is always preferable to

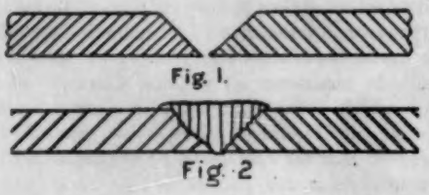

Fig. 1.

Fig. 2

use a motor generator set, the motor being constructed with attachments suitable for operation in the shop, and used to drive a low voltage generator. The generator may, if necessary, be driven by belts from a steam or gas engine, or from a suitable line shaft in cases where electric power is not available.

Various sizes of welds require different strengths of current, and means of regulating the current is necessary. This is readily effected by inserting resistance in the welding circuit, connecting it in series in the arc. This resistance is necessary, otherwise a short circuit would occur where the electrode was applied to the work when striking the arc. This would occur even after the arc is drawn and operation begun. The series resistance has the effect of steadying the arc. An electrode holder must be supplied, and if there are a number of forms, nearly all of which are so constructed that a spring or clamp which securely holds the electrode, may also readily remove it. The holder adapted for a metal electrode differs from that for the carbon electrode, being lighter and more compact. The carbon electrode holder also has a shield on the handle to protect the hand of the operator from the heat of the arc. This is not necessary in the case of the metal electrode, as the gloves of the operator are sufficient protection. A hood or shield is also necessary for protecting the eyes from the dazzling brilliancy of the electric light. Experience has shown that the window of the hood or shield is best adapted for operation when several layers of glass, one or more of red and others of blue or green, the combination being of a more subdued and softer effect on the eyes than any one of these colors used alone. A protection around the work is sometimes necessary as the strong light is confusing to other workmen who may be engaged in the vicinity.

Coming to the actual operation of welding, and assuming that two steel plates are ready for welding bevelled as shown in Fig. 1. If the plates are more than ½ in. in thickness it is good practice to bevel from both sides, if it is practicable to apply the electrode on both sides. The work, if small, may be laid in a metal table forming the positive terminal. With the resistance of the circuit properly adjusted for the work in hand, the circuit breaker and main switch being closed, the operator takes the electrode holder in one of his gloved hands, and with filling material, if necessary, within easy distance, and closing the window of his hood, and touching the electrode to the metal to be welded and instantly withdrawing it to a distance of at least two inches, thus igniting the arc. It should be borne in mind that with a long arc there is a lesser degree of opportunity for particles of carbon to enter the molten metal and thereby produce a hard weld. The heating effect of a long arc is also more regular with a more even distribution. An arc three or four inches in length is the most serviceable. If the arc is too strong, or too weak from insufficient current, the resistance in the circuit may be increased or decreased until the desirable arc is obtained.

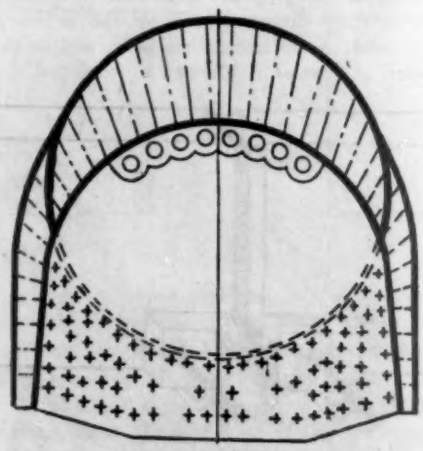

FIG. 3.

A rotary motion of the hand is necessary in order that the flame may strike upon a comparatively large area of the surface about the weld desired. A resultant cooling will follow with a lessened danger of cracking or the making of a hard weld, the arc being continued to play upon the surface of the metal until the metal is in a state of fusion, and the filling material, if used, combines and the whole is thoroughly melted. It is advisable,

*From *Railway and Locomotive Engineering*, New York.

if at all possible, to persist in one continuous application of the arc until the opening is entirely filled, as shown in Fig. 2. If a second application should be necessary care should be taken to remove all scale. A wire brush will readily clean the surface sufficiently, although sometimes chipping may be resorted to with advantage.

It may be stated here that with proper welding material, correct temperature and accurate heat control a perfect metal is

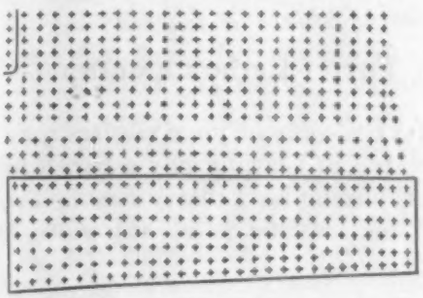

FIG. 4

formed, but the perfection in welding frequently eludes even the most painstaking operator. It is essential that the arc must actually touch and play over every part of the surface of the joint, otherwise the complete fusing of every part is impossible. There is no particular difficulty in the operation. It is a mere matter of taking care rather than of profound skill. The trouble, if it does come, is that the defects are completely hidden. No kind of inspection reveals the flaws until the actual tests are made. It need hardly be said that it is necessary to begin the welding process at the bottom of the weld. Fusing will naturally begin their first as the metal is thinner and the weld can be built up in a solid mass if the proper care is taken in the manipulation of the arc.

It should be borne in mind that although carbon electrodes have been referred to, the metal electrode process is a later development and has a distinct field of application differing in many cases from the older process. It has an important advantage in work where it is necessary to localize the heat to

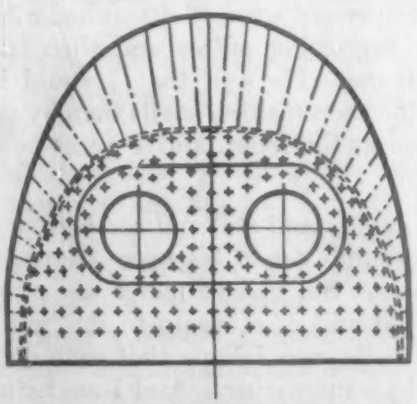

FIG. 5.

the greatest extent possible, thereby lessening the strains on account of expansion and contraction. There is perhaps no better illustration of this than in the case of welding a cracked bridge in a flue sheet. With the metal electrode process also it is possible that welding can be done in a vertical plane, and in many cases from beneath the piece where the repair is necessary. It may be stated here that the metal electrode differs from the carbon electrode in the length of the arc, the metal electrode being comparatively short, and also has the quality of furnishing the filling material itself as it fuses and flows into the work to be welded. A specially alloyed steel containing an extra quantity of manganese and copper has been found to add to the stability of the weld on account of the amount of these alloys that is burned out in the formation of the weld.

Again, as we have already stated, perhaps the most useful field for arc welding with the improved metallic electrode is in its varied use in railroad repair shops. The ingenuity displayed by skilled welders seems limitless. As an illustration, it is well known that small cracks are very apt to occur over the upper flues in the firebox side of the flue sheet. Before the introduction of autogenous welding this defect was difficult of repair. Small holes were drilled in the cracks, the holes were tapped and threaded pieces were screwed in and carefully riveted over, but in a short time the leaks showed again with all their attendant annoyance. Fig. 3 shows a method in vogue in the Long Island Railroad shops of effectually overcoming the difficulty. A piece of steel plate 3-16 in. thick is shaped sufficiently long to cover the refractory flues, with their attendant cracks, extending a short distance under the flue holes and lapping over the curve of the sheet on the top. This plate is securely welded on the water side of the flue sheet, and the flue holes subsequently filled up by the welding process on the firebox side. If it is deemed necessary to drill new holes for the flues this may be done and by leaving a slightly longer bridge between the new holes and the adjacent holes, a degree of security being thereby reached that has not failed in a single instance.

This may properly be looked upon as one of the smaller operations in repairing firebox or flue sheets. It is quite common to cut out pieces in the sides of firebox sheets extending to 10 ft. in length and embracing an area occupied by seven rows of flexible staybolts, and fitting a new piece with a V shaped joint as shown in Fig. 4 the piece may be welded in place by a skilled workman in five hours, and the bolts returned to their places, that portion of the sheet extending over the mud ring rarely requiring to be disturbed. Pieces of pitted crown sheets may be speedily removed in the same way and a new piece welded on the water side. Furnace doors also have been cut out on account of crack development, and a completed piece embracing outside and inside sheets fitted in and welded by the same process with a saving of 36 tap bolts. By the old process of repairing, the operation would occupy two men at least three days time, whereas one skilled welder would complete the job in nine hours, and after long continued service no further cracking of seams in the region of the fire doors has been developed. The extent of the repair is shown in Fig. 5. Indeed, it is safe to state that the repairing of firebox sheets is one of the most common jobs performed by the electric arc process in railroad work, in many instances the welded sheets being partially renewed a second or third time.

NEW PREST-O-LITE CATALOG

A new catalog has been issued by The Prest-O-Lite Co., Inc., Indianapolis, Ind., and is ready for distribution to the trade. The catalog covers all classes of welding and cutting apparatus and is very complete, covering the widest possible range of welding and cutting work. Preheating and reheating outfits are also described, as well as trucks, goggles, and other supplies. A copy will be mailed upon request.

The most stupendous and appealing call in the history of the world to aid suffering humanity confronts our Red Cross. Millions of men who have been fighting for liberty lie dead or wounded; millions of women and children are homeless and helpless; hundreds of towns and villages have been destroyed; disease and distress are rampant.

Up to now, our own people have not suffered. While Europe has been pouring out her lifeblood, America has experienced a prosperity she had never known before.

But now we ourselves are in this gigantic war. We now see that the struggle against autocracy and tyranny which our Allies have been making is and has from the first been, in reality, no less our struggle than theirs. We ourselves must now share the suffering which they have endured; we, too, must bear the burdens and we must do our part in a real way.

Why I Am Buying My Bond

An Editorial

From a Machine-Tool Builder—

WHEN you ask why I am buying Liberty Bonds, I take it you are interested in reasons other than the patriotic ones common to all of us. In my own case, it is enough that this is an American war loan and that I call myself an American. But as the head of a machine-tool building plant, I see additional reasons for buying these bonds.

This loan is to be the means of financing our Government war purchases, and nine-tenths of it will be spent in our own country. At least one half of our total appropriations will be spent for mechanical products, battleships, guns, rifles, automobiles, ammunition, railroad cars and locomotives, airplanes, submarines and the like. This first appropriation of seven billion dollars, of which this loan of two billion dollars is a part, is only a starter. As Frank A. Vanderlip says, "There will be other loans following this as soon as this is out of the way."

The total export of metal-working machines in our banner year of 1916 was less than eighty million dollars. The average annual output of mechanical products from all the machine shops of the United States is in the neighborhood of five billion dollars. What is going to happen, then, when several billions of good healthy American dollars are turned loose in the machine shops of this country? We will have to get busy as we have never got busy before!

Every dollar of the billions appropriated and to be appropriated will pass, directly or indirectly, through American machine shops. Every dollar will make its contribution to the activity of machine-tool builders and to the activities of the men who work with them to build these tools. As a plain matter of good business, it is up to me to help underwrite this Liberty Loan.

From a Turret-Lathe Operator—

PERHAPS some of your readers may be interested in hearing why a turret-lathe operator is buying his Liberty Bond. Trusting that this may be so at any rate, here goes:

In the first place, let me say that I am a real live American. At least I believe so and hope so. The work that comes from my mill is done right, because I take an interest in it and a pride in it. If all I had to live for was what the pay clerk hands me on Saturday (and believe me, I get as much as any of them), I would consider it time to die.

I belong to the shop bowling team and the shop baseball team. And let me tell you, when we go up against the other shop teams in an argument, I do my bit to help our boys bring home the bacon.

I went down to the recruiting station a month ago to join Uncle Sam's soldier boys, but the Super got wind of it and had a word with the recruiting officer and then had a talk with me. He said that I could help more in the shop making shells than by stopping them at the front, and I guess he was right.

But I can't stand still and see Kaiser Bill with his thumb up to his nose grinning at Uncle Sam. So, believe me, I am whooping this old mill of mine up to the limit on six-inch shells, and I hope that each one of them sinks a submarine. And I am helping Uncle Sam send some boys across too. For I have taken a hundred out of the old sock and bought my Bond!

From a Machine Designer—

A MACHINE DESIGNER is not apt to be sentimental, because his training makes him look very closely to see what makes the wheels go around. So in telling

Reprinted from the AMERICAN MACHINIST

why I am buying Liberty Bonds, I want to disclaim any emotional reasons. I don't even wear a flag on my coat lapel.

As a designer, I have been trained to admire truth, work constructively and look beyond the machine to the work that it performs. A beautiful smooth-running machine may produce terribly bad work.

I have always admired the smooth-working efficient machine that Germany actually is—until I have during the past three years seen the terrible work that this machine was really designed to do. I realize now that all the workmanship spent in building this great machine—the science and art and skill—was not for constructive, but for destructive purposes. I have seen that Kultur is not Truth, but a Lie!

If a machine that I designed should not do good work, I would be among the first to seize a sledge hammer and smash it. To my mind this Liberty Loan is really the sledge hammer that is going to smash the terrible German war machine—the machine that grinds up helpless women and children as well as strong men and then spews them out as human refuse.

That is why I feel it is up to me, as a designer of good machines, to buy a Bond and help to smash this bad one!

From a Machine-Shop Foreman—

EVER SINCE I was a little shaver, I have had two ambitions. One was to get married, and the other was to save money. What has the Liberty Bond got to do with these? Nothing with the first, for I got married six years ago; but a whole lot to do with the second.

I have two of the finest kids that ever wore out shoe leather, and a wife that is the best that ever was, except in one way—she can't save money. Every raise in pay that I get is lived up to. Sometimes I manage to get a few hundred away in the savings bank; but as soon as the wife finds out about it, there is something needed in the way of furniture or a trip.

But here is my chance, and I'm going to grab it. I am going to do my saving for the coming year in advance—now! I am going to buy a thousand-dollar bond on the installment plan. The two hundred in the bank will go as first payment, and I find that the firm will carry the balance for me over the year, taking weekly payments out of my envelope. We won't be as apt to spend this bond as we would money in the bank; and yet if we need money at any time, the bond is as good as gold. I'd like to see the savings bank that is as safe as the United States Treasury!

What we don't have in my week's pay we can't spend, and I figure one year of this is going to give us the saving habit that will take care of the home and the kids in the years to come.

So when I have this chance to help myself in addition to helping my country, you can hardly wonder that I am enthusiastic about it.

From a Machine-Shop Owner of German Birth—

I AM BUYING Liberty Bonds because I am a real American—not by birth, for I was born in Germany—but a real American at heart.

Twenty-two years ago I came to America with just enough money to get me past the immigration inspectors, and just enough words of English to get me a job as a machinist's helper.

My birth as an American did not take place on the day I received my citizen papers. It went back seven years before that to the day that my desire for American ideals and opportunities overcame the home ties and relations of the Fatherland. Since that day the pleasant recollections of the Fatherland have been fading, but in the last three years its wrongs against humanity have stood out blacker and blacker.

All that I have has come from America. She has clothed and fed me and given me shelter. Under her care I have grown in twenty-two years from a machinist's helper to owner of a large shop.

A child by adoption does not necessarily love a good mother less than a child by birth. America is my mother country. For twenty-two years I have needed her, and now she needs me. That is why I am buying Liberty Bonds.

The Welding Engineer

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Copies to paid subscribers	2,811
Copies to advertisers	85
Copies to prospective advertisers	75
Copies to other trade papers, correspondents, etc	60
Copies mailed as samples to prospective subscribers	1,059
Copies for office use	10
TOTAL	4,100

VOLUME 2. JUNE, 1917. NUMBER 6.

Business Slackers.

ELSEWHERE in this issue we are reproducing an advertisement published by an automobile manufacturer in an eastern newspaper, the title of the advertisement being "Don't Be A Business Slacker." A business slacker is a business man who is seized with writer's cramp in his check signing hand on the slightest indication of trouble. In England, after the beginning of the war, there was a general retrenchment, and later the slogan "Business As Usual" was adopted. We hardly believe, however, that we will witness any such a panic among American business men. Business will go forward as usual, and then some.

The Specialist.

SUCCESSFUL specialists in any line of mechanical work not only know their own work, but have a general knowledge of other branches bordering on or closely allied thereto. As a matter of fact specialization usually increases the ability to focus on one line of work a general fund of knowledge. The man who seeks to become a welding specialist should by no means be satisfied to simply be able to do good welding work. In fact, the welding specialist is called upon to display a great fund of general mechanical knowledge. Constant study and experimental work will make any good welder a better welder.

Industrial Preparedness.

A GREAT deal is being said about the need of men trained to drive and maintain motor trucks, ambulances, aeroplanes, patrol boats, officer's cars, etc., but very little is being said about the men behind, the fellows who will keep them operative. Such recognition as the art of welding is receiving by the government is sporadic and not at all conducive to efficiency. The army, for instance, recognizes a great many trades, but the skilled welder remains unclassed.

Any tank town mechanic is eagerly sought by enlisting officers, but the great value of the skilled welder, often an all-around mechanic, is unknown or ignored.

We are told we are going to put a million men in the field, which means thousands of automobiles of various classes. We are also told of a big aviation corps we are to organize. This means welders, hundreds of them.

It would seem advisable for the welding trade to organize, in order to be prepared when we are confronted by the need of skilled men.

Development of Technical Businesses.

THE application of science proceeds at an accelerated pace. The days have about gone by when one good idea would keep a family in business for several generations. No one dare rest content, for as Solomon remarks: "Yet a little sleep, a little slumber, a little folding of the hands to sleep, so shall thy poverty come." Every manufacturer and particularly manufacturers of engineering appliances and products, must maintain a constant output of improvements and new developments in order to protect his investment in plant, organization and good will, and indeed, to stay in business. As has justly been said, the invention of a new machine or process—by some one else—may be as disastrous as a fire, and far more likely to occur.

Moreover, the more progressive, the more advanced, a concern is, the greater will be its volume of new developments and improvements. Inventions breed inventions.

At the same time, the investment of time and money in research and development is a capital risk, that is, the preliminary investigation upon which the design of improved apparatus is based and the provision of manufacturing equipment and organization for turning it out must largely be paid for before the market for it can be developed. It is only by the prompt enlightenment of the prospective consumer, in other words, by educational advertising regarding the application and advantages of the new article that the loss of time and the waste which always intervene between the perfection of a device or process and its general use can be reduced.

General Business Conditions.

THE course of business has confirmed the opinion that war meant an increased stimulus to the industries, modified only by the necessity that under the pressure of more business than they can handle there must be contraction in some quarters in order that there may be expansion in others. Luxury trades are suffering, as inevitably they must, but that only means a shift of employment.

The great industries of the country, with steel leading, never before were under such pressure. Apparently the government requirements are proving to be more of a factor than was anticipated; at any rate private consumers are competing so vigorously with each other for the remaining capacity that prices are still on a rising scale. The annoncement that the British government has discontinued work upon the construction of a great new munitions factory for the reason that they would be able to buy more finished munitions in the United States shows the effect of granting credits and indicates that there is no end of this class of business except in the limit of our capacity. The departure of one engineering commission to Russia and another to France, and the annoncement that several thousand picked railway men are to be sent to France to put the railways in order, are indications of enormous demands from those quarters.

The welding trade may expect a steady and constantly increasing demand for apparatus and supplies. The indications are that the last half of 1917 will eclipse all previous records.

PROPER PREPARATION OF PARTS.*

The proper preparation of the parts to be welded should be the first care of the welder. A welder should realize that in order to obtain good welds it is necessary to properly prepare, clean and adjust the parts before lighting the blowpipe.

The surrounding parts of the weld should be thoroughly cleaned so as to remove scale and other impurities which tend to become imprisoned in the weld. It is just as necessary to clean the welding rod or filling material.

In welding steel ⅛ inch or more in thickness, the entire thickness of each side should be bevelled. This preparation, which many sheet metal welders or firms consider useless and not necessary, is indispensable for obtaining good penetration. All welds done without bevelling show, when tested by the etching test, a lack of penetration in the lower part of the plates which constitutes a very serious defect if the job has to withstand pressure. This lack of penertation is practically the same as a crack and easily extends the full length of the weld. A weld on plates ⅛ inch or more in thickness executed without bevelling or with the bevel too close is always irregularly penetrated. An examination of the underside of the weld reveals that the molten metal has run in a manner corresponding to

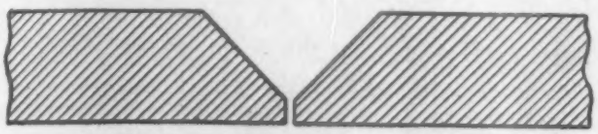


Fig. 1.—Partially Bevelled Plates.

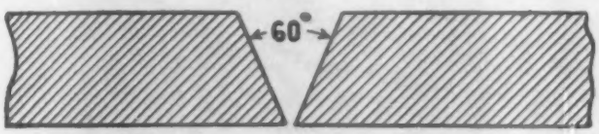


Fig. 2.—Angle of Bevel too Small.

Fig. 3.—Correct Bevel Angle.

holes pierced in the plate by the white cone of the flame. If the line of welding is cut between two consecutive baths of metal, the corrosion test shows that the penetration is only about two-thirds or even half the thickness of the plate. In addition to the bad penetration the metal, owing to its being overheated for a considerable time as a result of not being bevelled, has a very large crystalline structure and contains numerous inclusions of oxide.

Many welders turn the plates over and wash weld the underside of the weld. This method of work does not remove the serious defects of adhesion in the lower part of the welds and only tends to hide defects.

If very careful experiments are made on the consumption of gases in the case of bevelled and unbevelled plates, it will be found that the cost of gases in the case of unbevelled plates exceeds by 25 per cent that of the properly bevelled plates. It is obvious that the excess of heat consumed in the unbevelled weld has the effect of increasing the overheating effect on the steel, in other words it tends to entirely eliminate the ductility of the metal.

It is very important that the plates should be properly bevelled. Partial bevelling or irregular bevelling gives unsatisfactory results. Fig. 1 is an example of this type of the joint. For example, the following comparative results were obtained in the one case with the plates bevelled to an angle of 55 degrees, and in the other to 90 degrees.

PLATES BEVELLED TO 55 DEGREES.

Test No.	Tensile strength pounds per sq. in.	Elongation per cent.
1	46,860	10.9
2	44,730	9.5
3	41,180	5.0
4	45,440	9.0

PLATES BEVELLED TO 90 DEGREES.

1	51,970	18.7
2	53,960	18.0
3	55,370	18.3
4	54,950	18.5

The filling material, the blowpipe, the welder and the working conditions were the same in the two series of tests, the very marked difference in the ductility, as shown by the elongation, can only be attributed to the ease with which the weld can be made on a bevel of 90 degrees.

Too small a bevel, as shown in Fig. 2 for example, causes the welder to push the metal downwards in an attempt to join the lower edges of the plates; during this attempt the molten metal is seriously overheated and oxidation and blowholes are developed under the severe treatment to which it is submitted. This explains why the ductility of the first series of tests is less than that of the second and also why the strength is lower.

The welds should be prepared as shown in Fig. 3, there should be no holes or excess thickness when the lower edges of the plates are placed together. It is necessary to emphasize the fact that welds on mild steel made without proper bevelling lack ductility, lack strength, are costly, and frequently require wash welding.

*By D. Richardson in *Acetylene and Welding Journal* (England).

RULES FOR PRESSURE VESSELS.

A meeting of the Compressed Air Society was held in the rooms of the American Society of Mechanical Engineers, 29 West Thirty-ninth Street, New York, on June 12, at 10:00 A. M. The purpose of the meeting was to receive suggestions and discuss ways and means for drawing up a set of rules for pressure vessels. A preliminary meeting was held by the International Acetylene Association, in New York, on June 4.

NEW BOOK ON ARC WELDING.

A book which is sure to meet with a cordial reception by the welding trade has been published by the Lincoln Electric Co., Cleveland, Ohio, the title of the new book being "Electric Arc Welding." This book furnishes the most intelligent discussion of electric arc welding problems brought to our attention up to this time. In the opening paragraphs other systems of welding are discussed briefly, but fairly. No attempt is made to discredit other welding systems, but on the contrary they are recommended. The process of arc welding itself is discussed in great detail, beginning with a brief explanation of the principles upon which the system is founded and extending to various uses for the arc welding process. Considerable space is given to the operation of the system and many illustrations are used. Particular stress is laid on work in steel foundries, grey iron and malleable foundries, railroad shops, ship building and repairing, boiler plate work, electric railroad shops, drop forge shops, commercial or job welding plants, as well as for general manufacturing. Much information is given as to comparative costs. Here is a book those who are interested in welding should possess.

THE NEW WELDING ASSOCIATION.

The American Acetylene Welders' Association has been organized at Jackson, Mich., and a second chapter at Detroit. The following paper was read by Mr. B. Kopperschmidt before the latter club:

It is a great pleasure to me to be here and to talk a little while about forming an Association of Acetylene Welders in this city, with the following aims:

Of educating and being educated.

Of advertising our trade to the public.

Of giving the public and manufacturers classified welders.

Of protecting ourselves from unsafe apparatus or improper supplies.

Of protecting the trade from unjust slander.

Of giving manufacturers free unprejudiced advice.

Of devising a uniform basis of work.

Of forming a body of our best welders, who should act as a supreme authority in deciding the various problems that arise every day.

Of helping our Government when called upon.

Let's take the first principle of educating and being educated. Gentlemen, although we have a great many booklets and periodicals printed for the purpose of teaching us the trade, yet if one should put them all open on his desk, he will not find two of them alike; what one writer claims, the other condemns, and the welder behind the gun does not follow either method but his own, that he thinks and claims is the best. And how many times are those methods failing? Every welder knows the answer. Do we know what we ought to know in order to become a welder? Have we in the country a school that will teach us the gas welding trade on the same sound basis as a blacksmith, machinist or tinsmith is taught? No, we have none, therefore, gentlemen, our trade cannot be considered seriously by the public. It can be condemned or commended at will. How many welders can solve the expansion or contraction problems? How many welders know the properties or ingredients of metals? How many welders know technically the properties of acetylene or oxygen gases and its generation? How many welders know the difference between good welding equipment and a bad one? From good welding supplies and improper ones?

Cutting Heavy Steel Scrap with Electric Arc. Work by Thos. E. Sturman.

Editor's Note: Our readers may or may not agree with Mr. Kopperschmidt, but from our point of view the ambitions of this young association are to be commended, and merit the interest and support of the entire industry. A little group of earnest men in Jackson, Michigan, are attempting what should have been accomplished on a larger scale long ago. We advise the trade to take an active part in the deliberations of this body, rather than sit back and criticise later.—Editor.

I am a little afraid to give you my answer, because I believe that I am one of these welders that need study before I shall be able to answer properly the above questions. Yet I am appointed by my concern as a master welder. Gentlemen, let's get down to a sound basis and know once for all that we need education and if we are going to look for it and unite our present knowledge, education will meet us on our way to it.

Second, I said that we need to advertise our trade to the public. Gentlemen, without knocking our electric welding brothers, somehow they succeeded in going right by us and today you will find in this country that more people know about electric welding than they do about acetylene welding, yet the acetylene welding device covers a greater field in the reclaiming of defective metal articles than the electric welding device. Although we have for every one electric welder, a hundred acetylene welders in this country, yet when it comes to decide the success of either device, the electric welding device is given the preference, not only by some public but also by the Government men. This, gentlemen, is due to live advertising. It is not the welders that are advertising the process, but the electric power companies, manufacturers of electric welding apparatus. They are injecting the public with the proper dope that does the work. For instance I once heard a manufacturer addressing a railway club as follows: "The rapidity, flexibility, cleanliness, neatness, accuracy and economy of the electric welding process in all metals, has won for it such an important standing in the arts, that it overshadows all other welding devices.

Starting a Cut. Showing Hand Shield and Carbon Holder. Work by Thos. E. Sturman.

Now, gentlemen, I believe from my experience with both welding devices that this statement is due to the acetylene welding device, and it can easily be proven. But, who will prove it? No individual, but a strong association can do it.

Thirdly: Giving the manufacturers classified welders. There is at the present time a class of welders who have gained their experience only in aluminum work, others in cast iron, others claiming to be boiler welders and sheet metal. We also have some experts who claim to know all there is about acetylene welding. The result is, when a welder looks for a job in order to get it, he claims he can weld anything and everything under the sun. Some with three months' experience will deliberately claim a three-year experience, and as many shops are employing only one or two welders and have no other men in the plant to determine the value of these men, they are employed as welders and put to such work that they have never before performed. Thus, the shop that needs a good boiler welder may get an aluminum welder; the shop that needs an aluminum welder will get a steel welder; the shop that needs a heavy cast iron welder may get a sheet metal welder, etc. This produces a great confusion in the acetylene welding trade with the result that welders

are discharged, accidents happen and the gas welding process is condemned or discouraged.

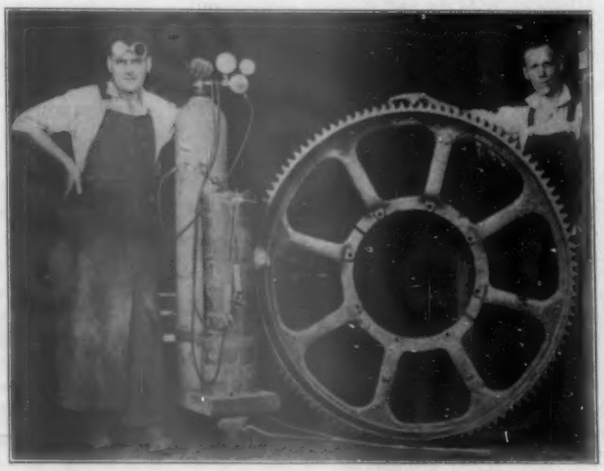
To help this confusion some of our apparatus manufacturers, or salesmen are stating to the buyers that any factory hand can learn to weld in a couple of days with their instruction book. We know that this cannot be done and in order to avoid this confusion, the Associations' aim should be to elect from the state, a committee or a body of the best competent welders; they in turn to devise four grades of examinations and to examine every welder and to give him a certificate as to his efficiency. If a welder should receive a fourth-class grade and has any ambition, he will study the trade further and in time receive the third, second and first-class certificate. In his study, of course, he should get all the help from the Association, and when a firm will employ a welder he will know from his certificate whether the man is qualified for his plant or not.

The next principle is that of protecting ourselves from unsafe apparatus or improper supplies. Gentlemen, we have at the present time more salesmen than good welders. They are all naturally striving to sell their wares, and purchasing agents are confused and do not know what or from whom to buy apparatus. In many cases, the buyer is willing to pay the price for the best apparatus, fit for his class of work, but instead gets an apparatus that results in failure. I have read advertisements that a welding and cutting equipment complete is sold for $50, promising to weld or cut articles from 1/32 to 15 inches. This equipment also includes a neat traveling case with welding rods, fluxes and all the necessary instructions. I have seen this apparatus and I believe that it is criminal to let any human being handle same. Such unsafe and unreliable apparatus should be eliminated and condemned by the Welders' Association. A committee appointed of competent welders should confidentially send due notice to such manufacturers to either improve their apparatus, and upon their refusal, should give proper warning to the welding industry of such apparatus. Of course, the cost should not have any weight in the decision of the committee. What we want in the market is safe and reliable apparatus and supplies, that will help the successful operation of gas welding.

Now, gentlemen, I mentioned another aim of this association and that is, the protection of ourselves against unjust slandering. There have been occasions when the gas welding process was justly condemned because men undertook jobs beyond

Welders from Davis-Bournonville Co.'s Shops (Chicago), with Their Families, Held a Picnic Decoration Day at Fox Lake, Wis. Bottom Row, Left to Right: Mrs. Ferguson, Mrs. Maurer, Mrs. O'Rourke, Miss Cathleen O'Rourke, Mrs. Rowe, Mrs. Vincent, Miss Woods. Top Row: Messrs. Ferguson, Maurer (Supt.) A. Maurer, Cole, Rowe, Vincent, Pavelio, D. Ferguson, Carby, O'Rourke.

them but there have also been many occasions when the gas welding device has been unjustly slandered because some men cannot or will not find the real cause of failure. Failures occur in any trade and the man who cannot fail, had better quit entirely. But to have more failures than successes merits condemnation and the aim of the associations should be to investigate these failures and to remedy them with accurate and reliable information to employers and employes. There are some successful boiler welders and unsuccessful and we have had failures and no accidents at all from boiler welding. But we have had some accidents on pressure vessel welding such as ammonia tanks, air drums and other vessels that are not riveted with bolts. Of course, these accidents were due to the incompetency of the operators. Yet our state boiler inspectors are working hard to abolish entirely the boiler welding. They even go further—without any lawful authority they are threatening welders with jail if they attempt to do boiler welding. What will protect us from such persecution? What will prevent their forming a law to abolish acetylene welding on boilers or tanks in Lansing? Nothing, at present. Without a union, they can make such laws to their hearts' content and we will go back-



A Difficult Welding Job by McColley Bros., Little Sioux, Iowa.

ward in our trade instead of going forward. If we had a strong and reliable association of acetylene welders, we could defend our trade from unjust laws and protect our very existence.

Now, as to the principle of giving free and unprejudiced advice to manufacturers. There are manufacturers who, in the absence of reliable authority, do not care to take any chances and adopt the acetylene welding device, regardless of the benefit they may receive. Personally, I have been called in, in many cases, to decide the adaptability of a certain production, whether it could be successfully welded and if the cost of welding would be less than the cost of riveting. I answered to the best of my ability but there may perhaps be a better answer than mine, and if we could have a bureau for the exchange of experience and information, we could increase welding operations to a great extent. This bureau should be composed of the best men in the trade, such as welding engineers, who would have the authority to recommend or prohibit certain operations.

Now, for the principle of devising a uniform base of welding. Why is it that we have no two welders performing the work alike? Each one claims his method superior and does not care to investigate the other fellow's method. One man will weld a ½-inch sheet with 30 pounds of oxygen pressure and another will use only 10 pounds. Another will preheat a gear wheel before welding and another will not. We hear that some are preheating an automobile cylinder too red, the others will heat them less. Some men claim that they can cut cast iron and others cannot. Some men are using carbon blocks to make vertical welds in cast iron which others condemn. Some men are claiming hydrogen gas better for cutting while others prefer the acetylene; some claim that aluminum can be soldered and be just as strong as welding, others are condemning it. Some men will weld side sheets in a fire box with all the stay bolts and rivets on; others will weld them without it. There are hundreds of such problems that are being performed in different ways; each welder condemning the other fellows' methods, and in many cases we cannot even give a reason why one method is better than another one.

But, I do believe that if the association would create a committee of competent welders with a great deal of experience, they can reach the proper decisions for the best method to follow, and only then can we standardize our work and abolish guessing and hoping for good luck, and raise our banner to the same height as the other trades.

Now, gentlemen, the principle of creating a body of men from the association who have both theory and practice in gas welding and, to the welding industry, should be a supreme authority in deciding important questions. There are many questions that one man regardless of his ability or experience, cannot answer as well as a group of experienced men. If we can organize Michigan welders and if other states would follow our example, then every state organization can elect two or three of its best men; thus we can obtain the best knowledge and experience of men over the entire country. Such a body of men should certainly be able to act as supreme judges in every important case that may arise in the welding industry. If our industry can command such a body, then instead of getting our verdict from some individual boiler inspector, or from some boiler makers' association that are always antagonistic to our trade, or from railroad officials who cannot or will not see the real advantage of the welding trade, we will get it from our own men but with a superior knowledge.

I read recently in the *Michigan Merchants' and Manufacturers' Journal* an article suggesting that legislators abolish the the acetylene welding. The writer went by unchallenged and his articles were read by men all over the state. Here is where our supreme committee could stop or challenge such articles with facts that could not be put aside without consideration. There is a new invention on the market, and X-Ray device where one can see the internal structure of a weld the same as a surgeon can see through a limb. This instrument should be of great value to a supreme committee of welders in deciding great problems of the reliability of welds in pressure vessels, etc.

Now, for the last suggested principle of helping our government with advice and welders. In the near future, our government will probably require the services of many skilled welders at the front, and at the ammunition plants. A welders' association can work together with the government experts in advising weldable operations and of instructing the necessary welders.

All these principles, gentlemen, could be attained by a welders' association quicker and better, with financial help. A good way to educate welders all over the country is to read a trade paper once a month in every city where an association is formed. These papers, including the discussion, should be printed in book form and distributed to all members, of all organizations. From our $3.00 yearly fee these books cannot be printed, therefore, financial help has a great deal to do with the success of the association.

I believe that if a welders' association can increase the growth of the welding industry, it will be just as beneficial to the big industries as to the welders themselves. Therefore, we will have to appeal to the manufacturers of welders' apparatus, supplies, carbide and gases for help, and thus united, capital and labor, we will grow and become successful in our operations.

There is only one welders' organization, about 40 members, at Jackson, Mich., of which I have the honor to be a member. The name of same is the American Acetylene Welders' Association. You will notice by the green ribbons on their coats that a number of the boys have come here to give you a lifting hand to organize a similar welders' association in Detroit, although we will gladly consider Detroit as our headquarters. Any other welders' organizations in the state should be your branches. Therefore, gentlemen, I urge that we get together and organize tonight the second welders' association and I have reason to believe that other states will fall in line.

Let Michigan be the first state to organize its welders and thus raise the standard and dignify the welding trade.

SAFETY FIRST FOR THE OXY-ACETYLENE INDUSTRY.

Safety first is taught to almost every industry on the American Continent. Special committees, selected from the best employes, have put all their efforts to educate every human individual on how to conduct himself so as to make safe his daily occupation. None, however, were suggested for the oxy-acetylene proposition, to educate the welders and cutters on the safety first subject. Therefore, I believe it is up to every conscientious welder to try his very best to prevent accidents in his own shop, and to contribute to the success of safety first by submitting in this paper his experience and some practical points so as to benefit the other members of the trade.

It is not necessary to appoint special safety committees and to stand as sentinels, to point the way safety to the new men, and thus perhaps prevent sorrow and destitution among our fellow workers.

Some of the unsafe practices men indulge in are: Making and operating home-made acetylene generators, repairing reducing valves by inexperienced men, testing reducing valves or gauges with oil, coupling reducing valves with oily gloves, generators near fires or lights, failure to wear goggles when engaged in welding or cutting, wearing improper goggles, failure to promptly repair defective parts after notice, the use of matches, careless handling of oxygen and acetylene cylinders; using an acetylene cylinder while it is lying flat in a horizontal position, failure to shut off the gases over-night, using a hammer to open an oxygen cylinder valve, failure to open cylinder valves slowly, failure to provide respirators, failure to provide a fire extinguisher for every welding unit or a bucket of water. These are a few of the practices that have made most of the welder funerals and cripples.

Home-Made Generators.

The most of our accidents are due to the operating of home-made generators and the chances taken are the greatest.

It is very peculiar to see a man spending money in buying his office and home furniture and machinery, yet he will make his own gas generator perhaps a few dollars cheaper. Such generators cannot be compared with the ones made by reliable manufacturers and designed by a whole corps of engineers. The home-made generators are not insurable, and by operating it one invites trouble for himself and for the whole industry.

The writer could cite scores of serious accidents due to such unreliable apparatus and, no doubt, other men in the trade are familiar with these accidents, therefore let us discontinue to make our own furniture, etc.

Repairing Reducing Valves.

It is well for an experienced welder to do minor repairs on a reducing valve, but one should not attempt to renew a spring, weld a hole or a broken part, or do other internal repairs that he does not understand much about. Not only good workmanship, but one's life depends on a properly constructed and properly kept reducing valve. The writer has seen cases where the whole side of a reducing valve blew out in pieces, because it was improperly repaired or adjusted.

The first and best thing to do to a defected valve is to send it to its home factory and have it repaired and tested by the same people who have designed it and manufactured it.

Testing Reducing Valves and Gauges With Oil.

In some large machine shops where the oxy-acetylene apparatus is employed, there is a great temptation to do their own repairing and testing just because they have experienced mechanics. At these plants they also have an efficient oil pump device to test steam or air gauges, but it is a very dangerous device to test an oxygen or acetylene gauge. It

is a well-known fact that oxygen under pressure has an oxidizing action on oil or grease, and the heat produced can start a brisk combustion with the result of serious accidents. Therefore one should abstain from introducing oil or grease in a cylinder or reducing valve or gauge.

Coupling Reducing Valves With Greasy Gloves.

There are some machine or automobile repair shops where a machinist is also operating an oxy-acetylene apparatus. At one of those shops a fatal explosion occurred because one of the machinists, who was previously employed on repairing a greasy radius rod with the same oily gloves, coupled the reducing valves to the cylinder. No doubt he introduced very little oil on the union of the valve, but it was sufficient to cause the explosion.

Generators Near Lighted Blowpipes.

Almost every human individual will abstain from keeping a tank of gasoline near a lighted torch or stove, yet we have many gas welders who simply love to have their portable generators near the lighted blowpipes.

The writer believes that the dangers are greater from an acetylene filled pocket than from the gasoline vapor. Why then invite such dangers? It is best that acetylene generators be kept out from welding shops in a separate building. If this is not possible, then a generator should be kept at least fifty feet from the works, provided the shop is very large, and there is plenty of ventilation.

Failure to Wear Goggles.

We all know that the human eye is one of the most delicately constructed parts of the body. To engage in welding or cutting metals without wearing goggles is to invite blindness, yet on a recent visit to some of the eastern welding shops the writer met a few men that were welding without the use of goggles. These men claimed that they could do better work without goggles, but the writer claims that welding goggles not only ward off the harmful light rays and insure perfect vision, but also protect the eye from the multitude of flying sparks produced by the welding or cutting of metals. It is really a bad habit to engage in gas welding or cutting without wearing goggles. The writer believes if all foremen or superintendents compel such employes to wear goggles, then in addition to protection, they will enable operators to do more and better work.

Improper Goggles.

Unfortunately we have some manufacturers who are selling to their patrons improper goggles or improper lenses. Some of these goggles have a steel wire frame, that is heating to the operator's face and has not the side protection for the flying sparks. Others have blue lenses that, instead of protecting the eyes from the ultra violet, intensify these rays and are most harmful. Why not charge a little more and distribute to the operators a welding goggle that will give them comfort, range of vision, and protection to the eyes?

Failure to Repair Apparatus.

There is a tendency among some welders to neglect a leaky hose or a loose union on the blowpipe or valve. The writer has seen recently a man welding a steel shaft with a leaky connection between hose and blowpipe. About every two minutes the leak, although small, caught fire and he continuously blew it out again. However, at one time gas collected in his glove and, without warning, the whole glove was a blaze of fire. Of course, another man had to finish the piston.

In another case the writer noticed a welder with a leaky reducing valve, welding a side sheet in a fire-box. About every two or three minutes he had either a decarbonizing or an oxidizing flame. Of course, he knew the difference and he had to stop at every period to adjust his flame properly. I believe that the man lost more money in time and gases than it would have required to pay for the proper repairs to that leaky valve. In addition to this loss, such defective reducing valves are dangerous and likely to blow out, and it is always best to keep all parts tight and in proper working condition all the time. The use of wire as a means to fasten the hose to the blowpipe or valve nipples is also a poor practice. A small clamp that is sold for about 5 cents is the best and safest means to fasten the hose so it will not leak, cut, or blow out under higher pressure.

The Use of Matches.

There is a practice among the majority of welders to use matches to light the gas blowpipe, with the result that sooner or later some of these welders and cutters are experiencing a bad shock, a liberal dose of sulphur in their lungs, and occasionally painful burns on their body. The writer remembers a case where an oxy-acetylene cutter was cutting off some rivet heads when a spark flew in his coat pocket where he had a liberal stock of matches, and set the whole of his left side in a blazing fire. The shock and scare was so great that he was ready to jump in a near-by tank filled with boiling water. However, he was stopped in time by some other employes who tore his coat off and all was over. To eliminate such bad experiences the writer recommends the familiar gas lighter that is sold by city gas companies, or at stores for 10 to 25 cents a piece. These lighters will light a blowpipe from one to two months and then a renewal tip can be secured for 5 cents that will last a similar period of time. These gas lighters are cheaper and safer than matches.

Improper Handling of Cylinders.

While oxygen and acetylene cylinders are tested to a great deal higher than the normal pressure, yet they may fail if exposed to shocks or if left to fall from certain heights.

The writer himself once experienced a case where an oxygen cylinder fell off from a locomotive running board to the floor and from there into the pit. With a terrific noise it traveled twice from one end of the pit to the other in about half a second. When the excitement was over we found that we had two nicely round holes in the cement walls about 6 inches deep. The only way we could believe that the cylinder made these holes was that the diameter of these holes corresponded exactly with the outside diameter of the cylinder. Fortunately there were no employes working at that time in the pit and no one was hurt.

Acetylene Cylinder in a Flat Position.

There is a practice in some shops where compressed dissolved acetylene is used in cylinders for portable work, to lay them flat on the floor or truck. They do this for safety, so that the cylinder should not upset, but the writer believes it is not a safety practice at all, and these acetylene cylinders should always be kept standing on its bottom on a vertical position, while in use. It is a well known fact that these cylinders are previously completely filled with a porous material (magnesia) and saturated with a liquid named acetone. This porous material saturated with acetone is absolutely necessary in the cylinder, because compressed acetylene under the influence of heat or shock is liable to decompose with violent explosion. But with the porous material that is rammed in the cylinder with a powerful press and saturated with acetone, the gas will not decompose at any point in the cylinder, as the pressure can only travel a very small distance being opposed by the porous material. However, if the cylinder is lying flat on the floor or truck, the acetone may leak out through the valve, hose, blowpipe, and into the weld.

Shutting Off the Gases When Not in Use.

That welder who has to pay the gas bills from his own pocket, shuts off the valves when the apparatus is not in use as a means of economy. But some employes in large commercial or railroad shops are neglecting to shut off the valves during noon hour and over night. The result of such

neglect are fires and explosions. A leak may develop over night, or at any other time when it is least expected, or the acetylene needle blowpipe valve may not be tight. A few years ago a number of welders were enjoying their noon hour with a game of pedro and lighted smoking pipes around their welding table. Although the men were smelling the odor of acetylene gas around them, their opinion was already settled, that acetylene gas must smell in every welding shop. However, when one man knocked some of the ashes of his pipe out, at that very instant an explosion occurred. It proved later that one of the acetylene blowpipe valves was wide open and all the cylinder valves were also open, the men probably depending on the blowpipe valves for any escape of gas. We could trace scores of fires that were the result of such carelessness and the writer believes that it should be the duty of every man employed in this trade to always shut the gas supply at the cylinder or generator when not in use.

Open Cylinder Valves Slowly.

A good conscientious mechanic in a power plant will always open the steam, air, or water valves slowly even if it contains only 50 pounds pressure, yet some of our welders are opening a cylinder valve that contains 1,800 pounds pressure just the same as they would open a water faucet. A man will not indulge in handing a 100-pound weight to another man from a 100 feet height by dropping it at him, unless he intends to harm him. The proper way is to lower the weight down slowly until the man below can reach it with his hands. That is exactly the same with the 1,800-pound pressure that is storaged in the cylinder, by opening the valve quick it will act the same on the reducing valve as the weight would act if dropped on the man's hands from a considerable height.

Provide Fire Extinguishers or Buckets of Water.

It is always best to provide for emergency cases a fire extinguisher in every welding shop. The writer has gone further than that and has a small pyrene fire extinguisher on every portable welding or cutting unit and they are employed every day, thus preventing small insignificant fires from becoming big. If fire extinguishers cannot be secured, then a bucket of water will serve the purpose.

Provide Respirators.

In some large shops there is a great deal of brass and bronze welding or brazing. The fumes occasioned by the later operations are harmful to the operator's throat and lungs. The only way to shield off these fumes is to provide and compel the operator to wear a No. 70 or 72 Chicago respirator, that works like an injector and protects him from fumes or gases derived from the melting of brass or bronze. The cost of these respirators are $2.50 and may last for years.

B. Kopperschmidt.

NEW USE FOR TORCH.

In connection with several of the large rubber manufacturers, there has recently been developed a process for cleaning non-skid tire molds and mechanical rubber molds by the aid of the oxy-acetylene welding torch. It is believed this process is new and as it seems to be coming into very successful use, it is anticipated that it will be of general interest to all connected with the oxy-acetylene industry.

Automobile and bicycle tires having projections on the surface to prevent slipping or skidding are commonly called the non-skid type. In the manufacture of these the plastic rubber is placed in a mold which has cut into it depressions exactly conforming to the design on the tire surface, and to prevent the rubber from adhering to the surface of the mold a facing is used. This facing consists of various materials, but principally powdered sulphur or talc, which accumulates in the depressions after a number of tires have been made. Due to the heat treating or vulcanizing of the tire, this foreign substance becomes baked onto the mold, adhering very tightly, so that it is difficult to remove by any of the usual methods, the most commonly used of which are hand scraping and sand blasting.

It was found that by playing the regular welding flame slowly over the surface of the mold, the objectionable material was softened and partially burned after which it was easily removed by a wire brush. In the experimental stages of the process both the oxidizing and the carbonizing flames were tried, but it was found that neither of these had any advantage over the usual neutral flame, such as is used in welding. The question also came up of the possibility of warping these molds, or damaging them due to heat, but it was found that the dirt was softened up long before the mold itself attained a dangerous temperature. Of course, care would necessarily have to be exercised for the beginner to determine how long the flame should be concentrated at one spot, but this can be readily detected, as the loosened dirt is easily distinguishable and the heat can be removed as soon as this condition is noticed.

Available data indicates that this process of mold cleaning is much quicker and cheaper than the other methods used. One of the Akron concerns who went into the proposition quite extensively, advised that by their old method of hand scraping one man with a helper could clean approximately five sets of molds in a day. These same two men with the oxy-acetylene process clean approximately twenty sets in a day, and the cost of gases was small compared to the work which was turned out. This concern had previously tried sand blasting, but found that after the mold had been cleaned several times, it was injured by the abrasive action of the sand. The Davis-Bournonville Co. are responsible for this new development.

FUNSTON IN ARMY WELDING SHOP.

This picture of General Funston was made a short time before he died. It was taken at the Welding Shop of the United States Army at Columbus, N. Mex. General Funston, accompanied by Col. Sickles and Capt. Fitzhugh Lee, had just inspected the Vulcan Oxy-Acetylene Welding and Cutting outfit which the Motor Transport Department had recently installed at Columbus to do the repair work for the motor trucks used by the Pershing expedition. When asked if he would pose for the picture, General Funston answered with a laugh:

Right to Left: General Funston, Col. Sickles and Capt. Fitzhugh Lee.

"Yes, but I'll have to have the same pay as the other bucks —Two bits!"

That was the price the Indians of New Mexico invariably asked when they were requested to face the camera.

From right to left: Genl. Funston, Col. Sickles and Capt. Fitzhugh Lee.

PENCIL ELECTRODE WELDING OF BOILERS.*

This paper has special reference to the welding of joints of drums and not boiler shells as the latter term is commonly understood. The trend of the times is toward that type of boiler in which all the tubes are bent, particularly in the large units such as those at the Commonwealth Edison Station in Chicago, the Delray Station in Detroit, the Ford automobile factory and the Solvay Process Co. Since the dimensions of the boiler rooms are growing out of all proportion to the size of the engine rooms, much higher pressures will be resorted to reduce the room required for the boilers. Drums are to be used up to 60 inches in diameter, and in order to bear a pressure of 300 or 500 pounds, the thickness of the plate will be very close to 2½ inches. There are several methods of making this joint by spot welding, and that which seems to have forged its way to the front is the pencil form of electric welding, which is now fairly generally used in steam boiler work, although as yet recognized only for low pressures. The weld made by this process is not so hard as others of the autogenous kind.

Advantages of Pencil Electrode.

In a weld, two pieces of metal heated to the proper temperature are united into one solid piece. Success of the process depends on bringing the pieces of metal to the proper heat. Electricity is used only to supply the heat, and in the pencil method only just enough heat is obtained to accomplish the joining of the two metals. All autogenous welding is accomplished by adding new metal to the joint to be made, and it is only in the pencil electric arc method that positive incorporation of the added metal with the metal to be joined is secured. By the electric pencil method fluidity is avoided and only just enough heat is used to make the plate and the electrode plastic, and there appears also to be an action in it which in the direction of the current tends to pull the metal from the electrode to and into the plate when just at the proper heat. This is so much in evidence that welding can be carried on overhead without the metal dropping upon the operator.

The temperature of the added metal in the gaseous and electric carbon type wherein fluidity is a condition approaches 2,800 to 3,000 degrees Fahrenheit, while in the electric pencil method the temperature of the metal being added is not more than 1,500 degrees Fahrenheit. This point that the temperature of the arc is so high, so hot, that there is danger of the metal becoming vaporized, is answered by the fact that the conditions surrounding this particular form of spot welding are analogous to and the same as for "forge welding" as carried on by the everyday blacksmith at his anvil.

Although the electric heat reaches an estimated temperature of 6,500 to 7,000 degrees Fahrenheit, in this process the metal wire does not have time to reach this temperature before it is added to the plate or in the usual groove which is to be filled with the welding metal. As fast as the metal wire becomes just plastic, the pencil must be advanced toward the work, or the arc gap will become too long for the electric arc to maintain its circuit. The distance needed for the arc does not amount to much more than ⅛ inch, because the voltages used are low, rarely exceeding 60 or 70, and failure on the part of the attendant to maintain this distance by constantly advancing the pencil is met at once by the extinguishing of the arc, because the gap becomes too long for it to maintain itself. Only in this process, carelessness is practically eliminated, both as to overheating and heating any considerable area, and the heated area is confined to the smallest dimensions of any; therefore the expansion and contraction strains are smallest. The wire forming the electrode only gets red hot at the point, showing the very localized character of the heat, the rest of the wire remaining black; while in the carbon form of electric welding, the carbon gets very hot from the point up to the holder.

Results of Tests.

Tests have shown that for pressures of 500 pounds per square inch, and with plates of 2½ inches or similar thicknesses, this method of welding makes a better joint than straps and rivets. To be sure that a joint so made will be stronger than the plate, and last indefinitely, it is only necessary to keep on adding new metal until the cross section on both sides amounts to more than the plate itself. This can be carried to extremes, and many as well be, just filling the groove, usually V-shaped, the extra metal to lap over on each side ⅜ or ½ inch, and made in bulged form, both inside and outside of the drum, taking on the form somewhat of a butt strap joint.

There has just been put into service, with a view of trying it out in actual practice, a small water tube steam boiler of the vertical two-drum type, with all the tubes bent and the drums have not a rivet in them. Heavy tests have been applied, and there is not the slightest doubt that the men who have to do with the erection of this boiler do not anticipate any danger to anyone from it.

*Abstract of a paper presented at the recent annual meeting of the American Society of Mechanical Engineers, by E. A. Wildt, Lackawanna Boiler & Grate Co., Scranton.

SILVEREX.

Editor: We have an inquiry for an alloy used in welding scored cylinders, known as "Silverex." Can you give us any information as to its analysis, where we can write for information, etc.? Western Welding Mfg. Co.

Answer: We do not know of any substance known as Silverex for welding scored cylinders. Probably this material is half and half solder, applied to the score with a soldering iron.

L. Lawrence & Co., 290 Halsey Street, Newark, N. J., and with branches at 1246 E. Jefferson Avenue, Detroit, and 1522 Michigan Avenue, Chicago, control the patents covering the filling of scores in this manner.

New Chemical Process Co., 6 West Ross Street, Wilkes-Barre, Pa., advertise in *The Welding Engineer* to sell complete outfit for $10.

Probably it is this method about which you inquire. It will be understood that it is a soldering—not a welding—repair and while the material is about the same as half and half solder, it is advertised as a silver-nickel process. Editor.

WELDING WITH HYDROGEN.

Editor: What has been your experience in welding light gauge steel and light cast iron with an oxy-hydrogen flame? Does the occlusion of hydrogen by the molten iron produce a spongy weld or is that merely a theoretical point?

Also could you tell me to what extent a mixture of hydrogen and acetylene has been used for welding light gauge steel and with what results?

Please answer through your "hints to welders" columns.

R. T. D.

Answer: Light gauge steel and thin cast iron are successfully welded with the oxy-hydrogen flame. In a properly adjusted flame the iron should not absorb the hydrogen, as this hydrogen should not be present in a free state.

Regarding a mixture of acetylene and hydrogen, we doubt very much the practicability of this method. To be sure, the acetylene enriches the hydrogen, or to put it in other words, the acetylene is diluted with the hydrogen. This requires two distinct combustible gases, and a special mixing valve, and we can see no reason why the gases should be mixed. Hydrogen is perfectly practical for the welding of very thin gauge material. When the metal is too heavy to weld with hydrogen alone, we would suggest that acetylene be employed without a hydrogen mixture. Editor.

Hints for the Welder

When you finish an interesting piece of work, can you set down on paper the manner in which you went about the job, how you prepared the work and how the job was done? Have you learned some little stunt every welder ought to know? Contributions to this department are paid for. Write it down any old way—I'll polish it up. Make a rough pencil sketch and our draughtsman will fix it up fine. Line drawings are more practical than photographs. Do it today—the men on the firing line are waiting.

L. B. Mackenzie, Editor.

ALUMINUM WELDING.

Editor: I was very much interested in reading the reply of J. W. Gannon to the article on aluminium welding in the February issue, by W. S. Penn. His remarks pertaining to the training of welders are certainly to the point.

Mr. Gannon gets "het up" over Mr. Penn's advice to treat aluminium cases exactly as if they were cast iron, and states that preheating, while not bad in the hands of a competent operator, is altogether unnecessary and entirely too hazardous.

Difference of opinions are what cause horse trades, and in trade papers, these same differences help bring out facts. Mr. Gannon is talking from his own experience, as he very clearly states.

In principle, Mr. Penn's instructions on the method of heating aluminium are a great deal more correct than Mr. Gannon's. Mr. Gannon says that cast iron, steel, brass and bronze will run together and unite, just as two drops of water will, under the action of the torch. With the exception of steel, none of these metals will run together like water without the aid of a flux, as Mr. Gannon very well knows. Using a proper flux on aluminium, as Mr. Penn clearly advised, this metal will run together much easier and much quicker than any other metal and can be treated exactly the same as cast iron, except that the weld will be made considerably faster than the same thickness of cast iron.

Whether aluminium cases should be heated or not depends almost entirely upon where the break is located. Sometimes it is not necessary to preheat; other times we may guard against stresses by sawing open the crack or by the use of water, but as a general rule it is pretty safe to figure that a case should be preheated to overcome contraction stresses.

Mr. Gannon is far too positive in his ideas that because he does a thing in one way, it is necessarily the only or correct way. He quite clearly shows this in his statement that aluminium will not flow together as other metals will, when as a matter or fact, aluminium will flow together much easier than any other metals, if the proper flux is used.

This comment is not an argument either for or against flux welding of aluminium. Personally, I believe in the flux method, yet I know many large shops using the puddling method with the utmost success. The chief point in favor of the flux system to my mind, is that students grasp the principles of aluminium much faster by its use and it is certainly much quicker.

Mr. Gannon criticizes Mr. Penn severely for preheating the case, yet in his own description of heating the crank case, he explicitly advises preheating. His difference of opinion with Mr. Penn seems to be that Mr. Penn uses gas and he uses charcoal, and that Mr. Penn advises waiting until the case will melt half and half solder, and he until it will fry oil. Yet it is quite possible to use gas flames on an aluminium case at times to better advantage than charcoal and Mr. Penn's degree of heat is certainly well within the bounds of safety.

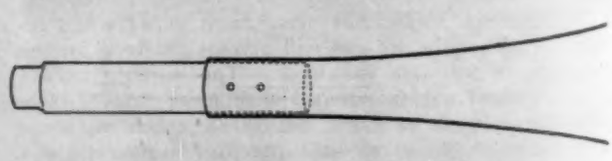
Mr. Gannon makes one other remark that I would like to have the welders think over, and that is never to weld aluminium from both sides. In the large city shops, nothing else is ever done. It would not be possible to weld a case where competition is keen unless the break was entirely welded, and on aluminium this can only be done by welding from both sides. If proper attention is paid to expansion and contraction this is a comparatively easy matter for the welder and the helper to accomplish.

Depending solely upon experience as Mr. Gannon has done is all right if we have no method of benefiting from the experience of others, but in these days of swapping information through our trades paper and text books, it seems that we should try to benefit somewhat by the experience of others.

F. C. Sanborn.

REAR HOUSING CONSTRUCTION.

Editor: Enclosed find sketch of rear housing. As now being manufactured two holes are drilled through the housing and hub, then riveted and brazed. I have suggested that the hub be welded in the following manner: The two halves of the housing shall be left with a space between them of about 5⁄8 of an inch for a distance the same as the distance the hub enters the housing. The housing stock is 3/16 and the hub ¼ inch. I



wish you would give me your opinion about this form of construction. Let me know if my method is practical.—Reader.

Answer: About the only sure method of determining the comparative qualities of construction is to try them out thoroughly in practice.

With the information given, we would say that your method seems to be thoroughly practical if the proper job of welding is done. We would suggest that an air-gas flame be used to heat the hub (because of the heavier metal) while the welds

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are being made. In addition to the two welds you show, we would advise that a circumferential weld be made joining the housing to the hub at the end of the housing. Admittedly, drilling the housing for the rivets and then brazing is rather an uncertain job and one which we believe will be entirely eliminated by automobile manufacturers in time. There is no certain method of determining whether the spelter bonds the two pieces or not, as it is out of sight while being done. The spelter may run through without the operator being able to determine whether it attaches itself to the hub and housing. The continual vibration of the car which is particularly strong in the rear housing, in time enlarges the rivet holes, and from personal experience we should say that this method of construction should be superseded by oxy-acetylene.

It occurs to us, however, that it might be possible to further strengthen the design by knowing all the details of the rear housing construction. Perhaps it might be possible and practical to combine the support for the differential bearings with the hub weld, or perhaps combine the hub weld with the brake drum cover.

We are glad to see you ambitious to change your present form of construction and heartily agree with you that an oxy-acetylene weld will be decidedly better than your present method. Nevertheless, we would urge that you build a sufficient number by oxy-acetylene welding to thoroughly test them out. Afterwards, the die for stamping the two housings can be changed to permit the 5/8 inch opening to make the weld.—Editor.

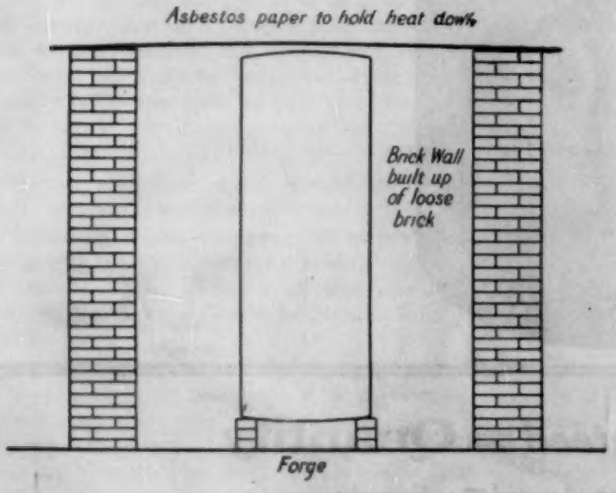
GAS ENGINE CYLINDER.

Several years ago I had a large gas engine cylinder brought to me, which had a large part of water jacket broke out from water freezing in it.

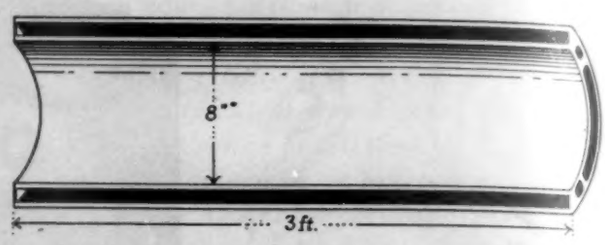
This cylinder weighed several hundred pounds and measured some three feet long, with a bore of eight inches.

The metal of water jacket was between one-half inch and five-eight inch thick, so you can understand it was not a light piece and had to be preheated.

The job was first undertaken where they were not equipped to preheat large castings. The way they undertook to preheat was to lay it on a cement floor and build a bonfire over it of light sticks of wood. Of course, they did not weld

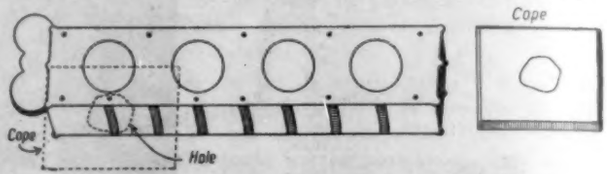


cylinder or even get started. After it was cool enough to handle, they brought it to me. I looked at it and knew I could weld it, but being busy I did not take a close look, and when my helper felt inside he found the bore was cracked all the way around and so badly warped that part of the bore had jumped to one side an eight of an inch. It was ruined as far as any practicable repair was concerned. This was in the early days of my own welding and I thought I had the reason all figured out why it cracked and how I was going to handle that kind of a job. I did not have long to wait until I received another cylinder of the same kind. I champered out the crack and laid cylinder on a brick forge and built a brick wall around it, started a good charcoal fire and covered with asbestos paper. After the fire had been



going an hour or so I found out my method was no better than the other fellows, as the inside, or bore of cylinder, broke with a sharp ring, making junk of an expensive piece and loosing the money I would have got if welding had been successful. To say I was discouraged would be putting it mildly. I was discouraged, but not defeated. I was ready to try it over again.

When the next one came in I sat it on end and on several bricks, as per drawing. I started a charcoal fire inside of cylinder, as well as outside, so heat would pass up both inside and around outside. Thus both inside and outside would



expand equal and at the same time. For if one or the other expanded faster, one would crack. A study in cross section would make what I mean more clear. It is in fact two cylinders fastened together at the ends.

Enough to say that I was successful in welding and have used the method many times, so feel it has been fully tried and will pass it on to help some other beginner.

There is also a moral to this history and that is, use your head and try again, success is sure to come.

Miller Welding Works.

PATCHING FIRE BOXES.

Inlaid patches on fire boxes of boilers have been tried in many ways, but have not been successful where two horizontal welds must be made, on account of the contraction and expansion being so great.

When the second weld is being made it will crack the first. I have tried the lap welded patches and find them to be a failure and have also tried the round patch, dishing same and using flatter and sledge hammering to dish out. They also failed in many fire boxes. By corrugating patches to take up contraction and expansion I have found welds to be very successful in many cases.

Side sheets often crack in locomotive fire boxes up a row of staybolts, two or three feet in length. In order to weld an inlaid patch in a place of this kind I would cut two rows of staybolts, making sure to get to the end of the crack, and boring space of one inch and a half each side of staybolts for weld. Patch must be made with three-quarter of an inch corrugation, fitted in place, with not more than three-sixteenths opening, beveled to 45 degrees. Patch may be held in place by tapping every other staybolt, screwing staybolts in same so as to hold patch flush with the sheet. The staybolts can be put in through the outside sheet and three-quarter bolt through the fire box side

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¶ Pull-U-Out is a new mechanical device that multiplies man's power by 73. It makes heavy lifting or pulling a boy's work. Thirty pounds pressure on the crank will lift one ton.

¶ With it one person, unaided, can pull a big touring car out of ditch or hub-deep mud, or right the car if overturned.

¶ Because of its light weight (only 28 pounds), and its great leverage and long reach, Pull-U-Out will revolutionize present methods of hoisting.

¶ Because it will operate in any position, and will pull horizontally as well as lift, Pull-U-Out opens a big field of usefulness not heretofore filled by any single device.

¶ Pull-U-Out consists of a substantial winding drum, a lever ratchet crank, a steel cable, a pulley, two 7-foot chains and three stakes.

¶ Three stakes make Pull-U-Out serviceable anywhere. They are the "hitching post" to which you can tie, no matter where you are nor in what position you may be. These stakes are the most astonishing part of Pull-U-Out. They hold their ground in a truly marvelous way.

¶ There are hundreds of lifting and pulling jobs for which no mechanical help has heretofore been provided—such as setting boilers, shifting machinery, raising radiators, pulling wires thru conduits, placing telegraph poles, etc. Pull-U-Out and one man will do jobs of this kind that now require from three to a dozen men.

Cheapens Present Methods of Hoisting

¶ In all ordinary hoisting in welding shops, factories, on construction jobs, etc., Pull-U-Out will do the work quicker and better than the customary chain-block. Where individual hoists are needed, Pull-U-Out is inexpensive enough to supply every workman with one.

¶ For spotting cars, stretching wire fences, pulling stumps, for painters' rigging and hundreds of similar jobs. Pull-U-Out surpasses anything now in use.

¶ No matter what pulling or lifting you can do now, Pull-U-Out will probably do it better. Don't pass this up because you can't see where Pull-U-Out can help you, or because you think it hasn't capacity enough. Look through the following pages, and you will find Pull-U-Out doing jobs you would never think of. One of them may be the very job that has been bothering you.

¶ Some sort of hoisting device is necessary in every factory where heavy lifting is done. The chain-block is usually employed.

¶ But the size, weight and cost of the ordinary chain-block make it imperative to rig it permanently in one spot; and few factories can afford separate chain-blocks for all the places where lifting is necessary. The result is that much lifting is done manually which might be done more easily, quickly and economically by machinery—if the machinery were either portable or sufficiently multiplied.

¶ Pull-U-Out solves this problem perfectly. Without auto chains and stakes, it weighs only 15 pounds; yet it has a lifting capacity of 3000 pounds. Larger sizes have greater capacity, up to three tons. When rigged to a light, portable crane, Pull-U-Out is instantly available for lifting in any part of the shop. Heavy objects picked up by Pull-U-Out can be moved on this portable crane and set down in another part of the shop without loss of time or necessity of loading onto truck for transporting.

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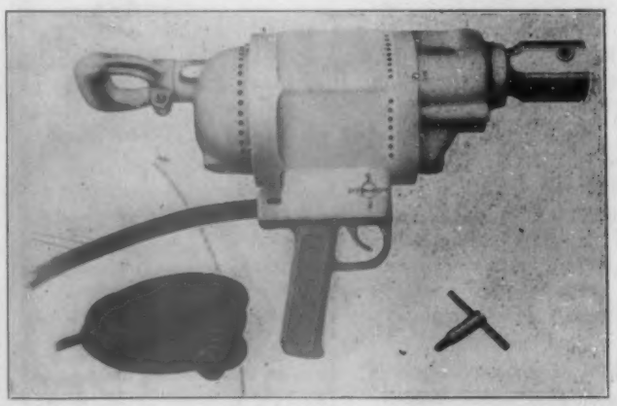


SAVES DRILLS

In designing this model, especial attention has been directed toward the prevention of breakage of small drills when operating the switch (a source of annoyance and loss with other designs).

It will be seen, by reference to the illustrations, that the control is that of the automatic pistol, one finger doing the work without in the slightest affecting the steadiness of the aim or the firmness of the support of the tool. There is no releasing of the grip to turn the switch or press a button, or push in or pull out a handle at the moment the drill breaks through.

You simply pull the trigger without the slightest wavering of the tool or sagging of the weight, and consequently the drill is stopped without breaking the drill bit.

H. G. DORAN, Peoples Gas Building, Chicago

to hold patch secure. When welding weld may be started from bottom on either side. Continue weld until opening closes, then start on other side and continue, first one side and then the other, until the top of patch is reached, welding top last.

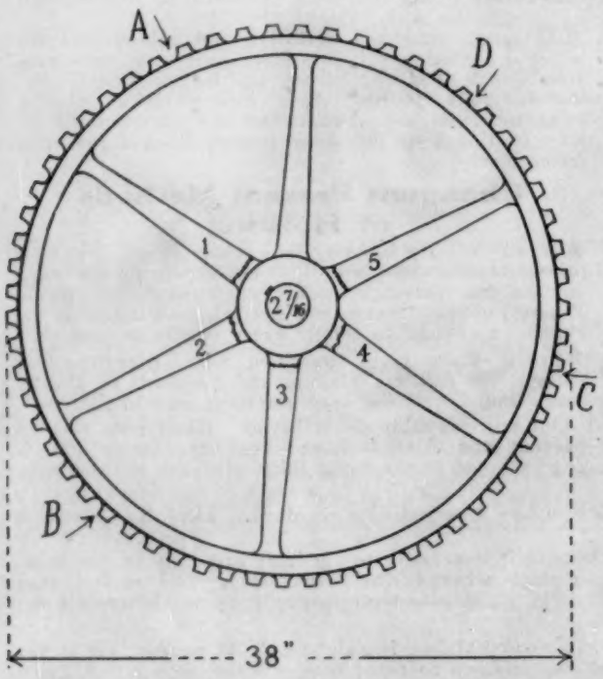
I have known of two of these patches that have been welded in along side of brick arch and have been in service for nearly a year and have given no trouble as yet.

Glen Loucks.

SPROCKET WHEEL.

Editor: I am enclosing a sketch of a 38-inch sprocket wheel for a No. 103 link belt chain, with five spokes broken close to the hub, as marked in the sketch.

I welded this wheel in the following manner: After beveling out all of the breaks, I put the hub in the fire in the center of the forge to heat the hub so as to be sure and get a good weld on account of spokes being broken so close to hub. Then I built a charcoal fire on the rim at A and



B. While the rim was heating I let the hub get pretty hot, slowly. When hot enough I welded spokes Nos. 1 and 2 on both sides. While these welds were cooling off I changed the charcoal fire from A to C and as soon as the rim was hot I welded spokes Nos. 3 and 4 on both sides. Then I let these welds cool off to about the same temperature as the hub. In the meantime I changed the charcoal fire on rim from B to D. By the time the last two spokes cooled off spoke No. 5 had opened up nicely and I proceeded to finish by welding it.

I kept the fire on the rim and reduced the fire under the hub so as to cool them off as near together as possible.

I figured that the cooling off process was almost or quite as important as the heating and that the main thing was to keep it round and true or to keep it from warping.

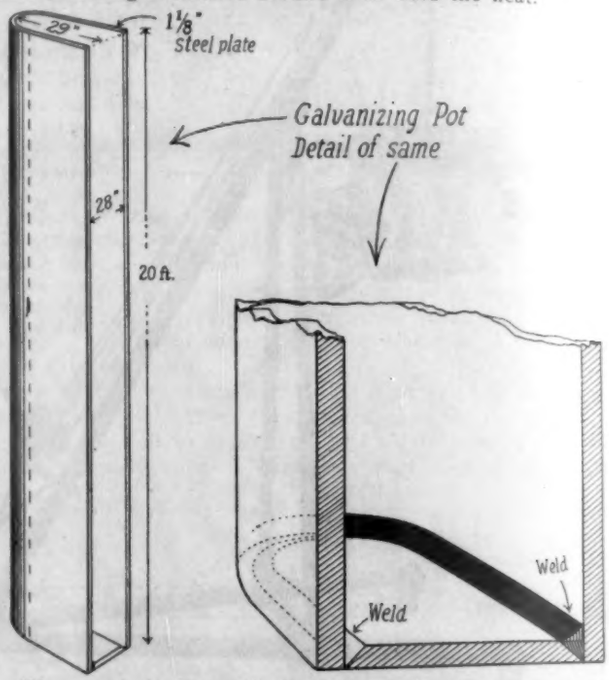
Well, I was certainly pleased when I found that I had succeeded splendidly, almost perfect.

Now, I want to know if this was the correct method, or was it just "fool luck." Of course, I don't think it was *luck*, but I would like to know what an experienced operator thinks of the method and results.

W. A. Bennett.

GALVANIZING POT.

Editor: This sketch is of a large welding job we had in our shop today. We used a large water cooling torch requiring about eight hours to weld one head, preheating with a wood fire, as we seem to get better results from slow heating than with portable burners. We placed the pot on three pieces of 8-inch pipe, about 12 inches long, standing this distance from floor, afterward bricking in same, making a furnace around it to hold the heat.



We raised the pot with traveling crane, having a shackle in each side of pot, securing the pot with wire rope around it about four feet from end and taking a lashing from the back, making a bridle of same. We still have another one to weld heads in. This is one of the heaviest jobs I have ever had of welding plate of this thickness.

I have about fourteen welders, of which ten were helpers who have learned from the start by cutting plate. We have quite a lot of acetylene cutting and welding in the navy yard.

J. A. Stewart.

FALSE SPOKE.

Editor:

Please advise me as to the enclosed job:

No. 2 broken and wheel spring 1 inch from spoke.

No. 1 broken and bent 1⅛ inch in strain.

No. 3 broken gear entirely out.

I placed clamp from driving slot to the outside of wheel to pull down No. 2 to place. Then straighten No. 1 to right position. I made a false spoke and placed as per dotted line, welded No. 2, then No. 1 and started on my false spoke. When my job was complete, a crack appeared where I have the heavy line.

Chas. B. Edinburgh.

Answer:

We are unable to determine the reason why you made a false spoke. You welded the job correctly in first welding No. 2 spoke, as the broken spoke No. 1 gave you an opportunity for proper expansion and contraction. In welding No. 1 next you would not be bothered materially by expansion and contraction as the opening of the broken face at No. 3 allowed sufficient play in the expanding and cooling of spoke No. 1.

Your trouble is directly traceable then to your ingenuity in putting in a false spoke. If you had left this out, and made the weld in the rim, we cannot foresee any reason why it would not be successful. We are sending you a sketch.

Editor.

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By S. W. MILLER

237 Pages, 6 x 9 Inches, 192 Illustrations

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Ten years ago the oxy-acetylene method of welding and cutting metals was hardly more than a laboratory process, but in the course of these few years it has become one of the most important of the methods in the metal-working industries. Much has been published relating to this process, but a great deal of that which has been placed on record in the past has been descriptive of odd jobs. It is, therefore, believed that the present volume, dealing in a more systematic manner with the principles and practice of the art of oxy-acetylene welding, will be of considerable value to those engaged in the metal trades.

The information here presented on the subjects of oxy-acetylene welding and cutting has been mainly furnished by S. W. Miller, proprietor of the Rochester Welding Works, whose wide experience in the practical application of the process, and whose success in the work, vouch for the reliability of the information here placed on record. The experience of the author in the oxy-acetylene welding field has been unusually extensive, but having been mostly on repair work, he has written especially for those engaged in a similar line. A great deal of the work done with the oxy-acetylene welding torch is on repairs, and while there are also a great many applications of it in manufacturing work, such applications are more or less special in each case, and sometimes require a great deal of experimenting before success is attained. The general principles here presented, however, apply equally to repair and manufacturing work. This volume describes the equipment required for oxy-acetylene welding and cutting, deals in detail with methods used in welding cast iron, malleable iron, steel, copper, brass, bronze, and aluminum and gives in addition, special attention to the welding of sheet metal, tank welding, boiler repairs, etc., as well as to the subject of lead burning, which is a special kind of autogenous welding.

The book contains twelve chapters headed as follows:

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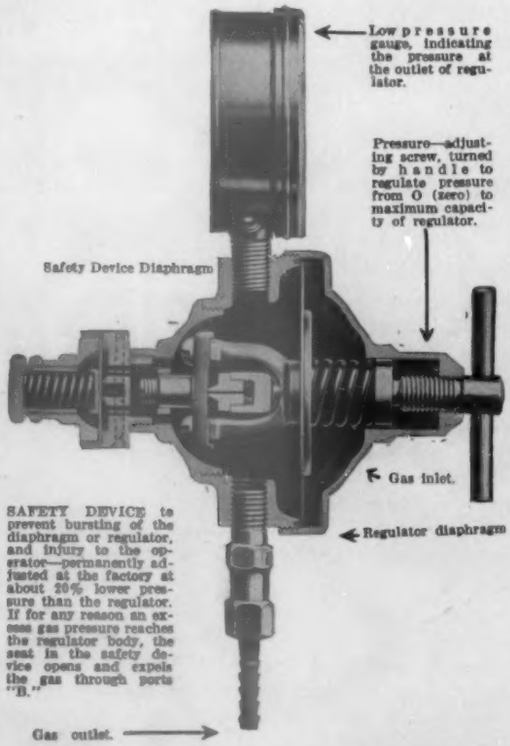
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BOILER WORK

Editor: I was called to look at a boiler at a Gas Plant the other day. The boiler is about 6 ft. in diameter and about 12 ft. high and carries about 5-lb. to 10-lb. steam pressure. When the boiler was first put in, it was set in the ground about 18 in. and that caused it to rust full of little pin holes and it will be necessary to put a patch on about 18 in. by 3 ft. long. The boiler is about ⅜ in. thick.

I would like to have you tell me how I should go about to put this patch on with an acetylene welder.

Will you kindly let me hear from you by mail as soon as convenient? A. T. Akerman.

Answer: Cut the old material out if possible with the oxy-acetylene blowpipe, and bevel the edge to a 45 degree angle. The corners should be cut round as per sketch, Fig. 1. Next cut the patch with the corners round, about ⅛" smaller than the hole and bevel the same to a 45 degree angle. It is then necessary to set a ⅜" deep groove at E, Fig. 1. After the patch is rolled the same radius as the boiler, it should be set in with all the edges separated about ⅛" as per Fig. 2. The patch may be secured in 2 or 3 places with bolts or clamps. Then proceed to tack the edges 8 to 10 inches apart, one opposite the other. After this operation, start to weld at A to B, then from B to C, then C to D and finish from D to A.

We are sending you a sketch.

If compressed dissolved acetylene is used, the oxygen pressure should not exceed 8 lbs. The welding rod should be ⅜" pure Norway iron.—Editor.

BOILER WORK.

Editor:

Enclosed please find sketch of an upright boiler which I have just welded, but not to my satisfaction.

The cracks were between the flues. I first cut it out with a diamond point chisel, heated it and drove the edges in. Made the weld with Norway iron, but when it cooled it checked again ¼ inch from the weld, on the under side.

I also would like to know if Tobin bronze can be used in cracks of this nature, also around the ends of the flues after they have been expanded.

If you will kindly explain why I had trouble with this weld I will greatly appreciate same, as I have four more to weld.

Subscriber.

Answer:

"Bevel the cracks to a 55 degree angle and leave a ⅛ inch opening between the edges. Then preheat to cherry red at the dotted lines E and F and G and H. Then weld from bottom up at B. It is not necessary to drive the edges in, but the weld should be carefully made, so that both edges should melt when the ⅛ inch welding rod is applied. The flame should be neutral and the oxygen pressure should not exceed 10 lbs., if dissolved compressed acetylene is used. At this pressure the metal will run nicely and not run away from the edges.

When the crack at B is finished, preheat between I and J and K and L and weld then the crack at B2.

Tobin bronze should never be used on boiler work of any kind. The welding around the ends of the flues with the acetylene, when the flue is beat over with the copper ferule, is not practical and should not be attempted.

It is also important to remove the flues at each end of crack B1 and B2 before beveling and welding."

We are sending you a sketch.

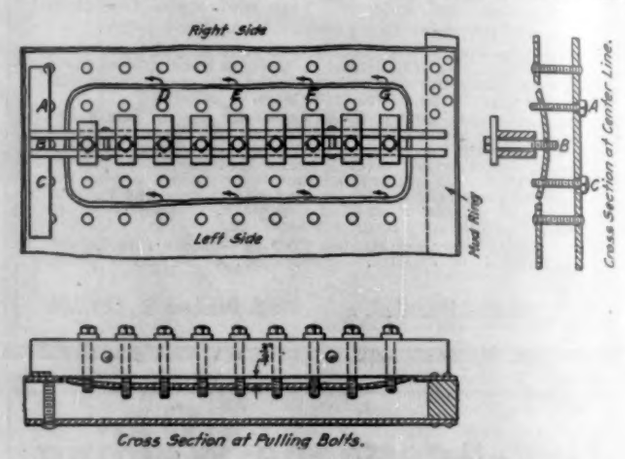
I would be glad to have any comments you care to make on this solution. Editor.

ASSISTING SHRINKAGE IN AUTOGENOUS WELDING BY MECHANICAL MEANS.*

The greatest difficulties to be overcome in autogenous welding are produced by expansion and contraction and they are especially troublesome in welding locomotive firebox sheets. Welding vertical cracks through several staybolt holes in bad sheets will invariably start trouble in the next parallel row, the cause being checks on the water side that develop and extend when contraction strains are set up at the adjacent row. It is generally supposed that the electric welding process with its small area of heating and limited amount of expansion takes care of all work of this kind. While there is no doubt about its success in a good sheet, it may fail if the sheet is checked on the water side.

In the job which was finally handled as shown in the sketch, a vertical crack was found which extended continuously between nine staybolts. This was electrically welded, and on cooling the next row of parallel bolts showed a crack eight bolts in length. On welding this row the next one cracked for a length of four bolts. The sheet had one riveted patch, and with this additional trouble, it was slated for the scrap pile. There was only one thing to do: weld in a patch and finish the sheet without leaving any shrinkage strain.

In the sketch, row *A* was the first one welded, *B* the second and *C* the third. These three lines of bolts were cut out and



a box patch placed as shown. Rows *A* and *C* were flexible bolts and screwed in position to hold the patch in proper relation to the side sheet. It will be noticed that the patch is dished about ¼ inch towards the water side which allows ⅛ inch for shrinkage when the patch is brought out flush with the sheet. Over row *B* and extending the width of the sheet were placed two parallel bars one inch by four inches, riveted together one inch apart. Between these bars and extending into the holes of row *B* ⅞-inch bolts, supported by straps, were screwed tight. The upper ends of the bars were supported by a plate which extended horizontally along the sheet for a distance equal to about five rows of staybolts; the lower ends were supported by the sheet and mud ring. The sheet was thus protected from a concentration of the load on the bars.

A patch of this kind should not be tacked unless absolutely necessary. The weld was made with oxy-acetylene, beginning at point *D* on the right side and working up to the corner, then dropping to *E* and working up to *D*, and so on, finishing the right side at *F*. This method of dropping down by eight-inch steps equalizes the strains and keeps the work at a more uniform temperature, as the beginning of each section is made on cold metal and finished on metal which has had time to cool. The left side is welded in the same manner, but as the weld proceeds pull the dish out of the patch with the middle line of bolts. If necessary, the completed weld on the other side should be reheated.

The parallel bars are removed after the vertical welds are completed, and the ends finished. This method of applying the patch leaves the sheet without tensile strain after the weld has been completed.

*By E. S. Norton, in the *Railway Mechanical Engineer*.

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Orders filled Day and Night

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PROOF THAT ADVERTISING LOWERS SELLING COST.

The rising cost of living is the great universal hardship of the present day. So great and so many have these rises been that few people stop to realize that there have been any exceptions to the general rule. But the fact is that there have been numerous exceptions and all of these exceptions belong to the same great class—that of nationally advertised goods.

The old idea that the cost of advertising raises prices dies hard. But the business man knows better. He knows that selling goods is costly business—no matter what the goods or what the selling methods. And he knows that anything which creates demand on a large scale, and thus makes selling easier, is bound to reduce selling costs and thus helps to reduce prices.

But evidence is better than argument; facts are better than theories. The Association of National Advertisers, an organization of 260 of the leading advertisers of the country, has been at great pains to collect the facts. It has secured an immense body of data from its members which proves that advertising does reduce selling costs and thus tends to reduce the selling price of advertised goods. "The proof of the pudding" is the argument that settles everything.

To present all the evidence, instance by instance, is impossible within these limits. A few representative cases will suffice.

The makers of a famous photographic camera, when they began advertising twenty-eight years ago, made one camera which took a 2½ inch picture and which sold at $25. Today they make a far better camera which sells for $10. Another, which took a 4x5 picture, sold for $60. Today they sell a far better one for $20. And so on through the line.

A prominent hat manufacturer has, by means of advertising, reduced his selling cost seven cents per hat. Result—the buyer gets a hat of better quality at no increase in price; this despite increased cost of raw material and workmanship.

When the manufacturer of a famous breakfast food specialty began advertising, his goods sold at 15 cents a package. Today the package is fifty per cent larger and the price has been reduced to 10 cents. Again advertising did it, the same causes producing the same results.

The producer of another well known food specialty is selling his goods at 25 per cent less to the wholesale grocery trade than four years ago.

Twenty years ago a nationally advertised shaving stick was sold in a cheap metal leatherette covered box. Today a stick containing 20 per cent more soap is sold in a handsome nickel box at the same price.

Then take the most conspicuous example of them all—the automobile business; and compare the $5,000 or $10,000 cars of ten years ago with the equally good cars of today, selling for a fraction of the money.

And so on through a long list. In every case, the manufacturer either has been able to lower the price or improve the quality at no increase in price.

How has he done it? By means of advertising, which has created demand on a larger scale and thus permitted production and distribution on a large scale. Result—improved manufacturing efficiency and reduced selling costs. And all of this in the face of a steady increase in the cost of labor and raw materials which, with advertising eliminated, might in many cases have fairly doubled the price of the goods.

"A triumph of economical marketing" is the only possible verdict for advertising in the face of these facts.

FENDER FLAG STAFF HOLDER.

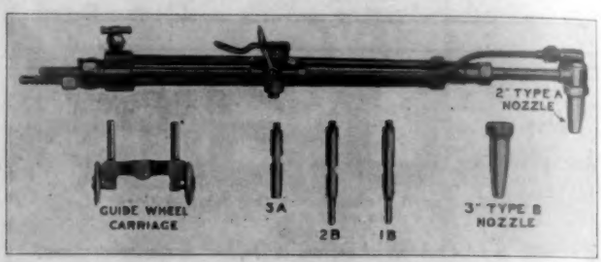
The McGriff-Kimberly Manufacturing Co., Anderson, Ind., are manufacturing a fender flag staff holder for automobiles, in which the welding torch plays a part. The holders are made from a small piece of steel tubing, welded to a strip of bar steel, same being bent to fit fender rim, being fastened with a set screw under fender.

RIVET CUTTING TIP.

For cutting off rivet heads and staybolts flush with plates, by the oxy-acetylene process, it is desirable to have a cutting tip so designed as to permit of the gas jet playing parallel with the plates.

To meet this need the Prest-O-Lite Co., Inc., of Indianapolis, Ind., is manufacturing a special rivet and staybolt cutting attachment. This attachment is used in connection with the type K cutting blow pipe shown, being screwed into the head in place of the regular cutting nozzles. The copper tip is bent at a convenient angle and is adjustable to any position, facilitating operation in close quarters.

RIVET CUTTING ATTACHMENT



Much cleaner work in rivet and staybolt cutting is possible with this attachment than with standard cutting tips which do not permit of a cut truly parallel with the plates.

Classified Ads

Help Wanted—25c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—50c per line, minimum 4 lines.
Count 8 words to line. Add 6 words for keyed address.

Job Wanted—Man experienced as Brazier and as welder in small work. No experience in large. Good mechanic. Will go anywhere. Have been foreman. Address M-2, care of The Welding Engineer.

Wanted—Salesman to solicit subscriptions to *The Welding Engineer,* or furnish names of possible readers. Compensation good. Correspondence confidential. Write Mackenzie.

Wanted—First-class oxy-acetylene welder for all kinds of jobbing work, mostly broken coal mining machinery, such as gears, mine locomotive castings, etc., in cast iron, steel and brass. Must be especially good on heavy, intricate machine work. Man with blacksmith, boilermaking or machinist experience preferred. Steady employment at such work when not otherwise engaged. State age, pay expected and furnish best of references as to capability and habits. Address Egyptian Iron Works, Murphysboro, Ill.

Wanted—An experienced man in the use of ox-weld and electrical outfits for welding cast iron castings. Address E. F. Co., Inc., care *The Welding Engineer.*

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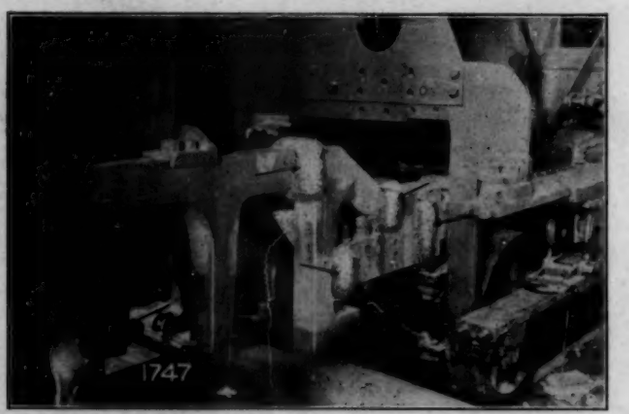
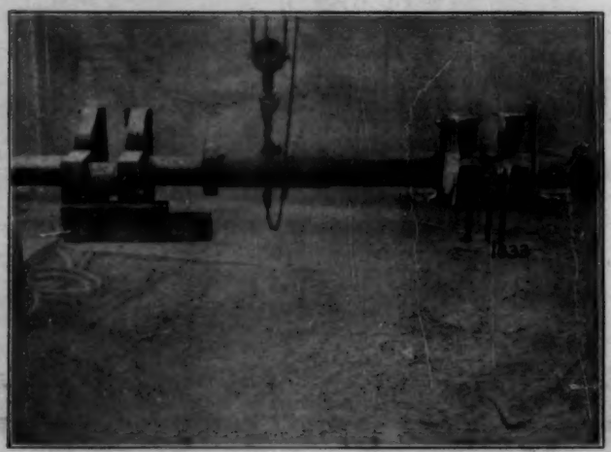
The Largest Producers of the Purest Oxygen in the World

New neck cast on to large roll made with the aid of Thermit and having the pods cast in at the same time.

Large bevel gear on which two new teeth and crack have been repaired.



Four Thermit welds on locomotive frame on the Missouri Pacific Railroad, made without removing the frame from place.



New crank pin welded in by the Thermit Process.

Thermit Does the Heavy Welding and Does It Right

The Thermit Welding Process is the only one that is best adapted to repairing of heavy sections (see illustrations).

Thermit will repair such sections quickly and economically. Many serious delays have been avoided from the use of Thermit Welding and saved thousands of dollars in time and expense.

If you have a breakdown

wire or telephone our nearest office and we will proceed at once for arranging the shipment of materials and send an expert to supervise the repair.

We have an eighty-page pamphlet devoted exclusively to this class of work, which is known as pamphlet No. 1779, and tells how the work is executed and how you can do the work yourselves.

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